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Bell Telephone MAGAZINE

An Address before the U. S. Independent Telephone Association • WALTER S. GIFFORD

"I Knew Then I Was Home" • BURTON A. HOLLINGSWORTH

For Heroism, Gallantry, or Extraordinary Achievement • DONALD S. BRIDGMAN

The Rôle of Electronics in Telephone Service • AUSTIN BAILEY

A Hurricane Strikes Again • JUDSON S. BRADLEY

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The World's Telephone in War-time • KNUD FICK

American Telephone & Telegraph Company · New York

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"The ideal and aim of the American Telephone and Telegraph Company and its Associated Companies is a telephone service for the nation, free, so far as humanly possible, from imperfections, errors, or delays, and enabling anyone anywhere to pick up a telephone and talk to anyone else anywhere else, clearly, quickly and at a reasonable cost."

A Medium of Suggestion & a Record of Progress

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WALTER S. GIFFORD, *President;* ROBERT H. STRAHAN, *Secretary;* DONALD R. BELCHER, *Treasurer*

Who's Who & What's What

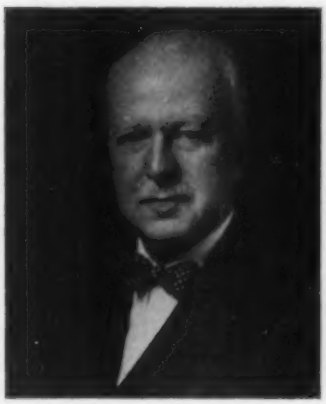
in This Issue

DURING his four decades with the Bell System—the anniversary was last July—WALTER S. GIFFORD has seen the common interests of that System and the so-called independent telephone companies increasingly recognized, and his address which is this issue's leading article is both a contribution to and testimony of the present coöperative state of affairs.

It took Mr. Gifford just under 21 years to go from payroll clerk in the Western Electric Company to the System's top job: President of A. T. & T. Company—even with time out for an important part in World War I in civilian executive capacities. More than twenty-five years later, in this war, he is Chairman of the Industry Advisory Committee of the Board of War Communications.

Concerning Mr. Gifford's many charitable, educational, and scientific interests it is perhaps sufficient to cite that a few years ago he received the gold medal of the National Institute of Social Sciences in recognition of his services "as Director of the Council of National Defense; President of the Charity Organization Society of New York [now the Community Service Society]; Trustee of Johns Hopkins University, General Education Board, Carnegie Institution of Washington; Director of the President's Organization on Unemployment Relief; President of the American Telephone and Telegraph Company, the greatest non-governmental organized service in the United States; and as trustee of numerous educational and scientific foundations."

TELEPHONE PEOPLE ought to get a lot of heartwarming satisfaction out of knowing that the service they provide can do so much to buck up the wounded fighting men who are returned to this country for hospitalization. Since early last year, BURTON A. HOLLINGSWORTH has been spending much of his time in visiting Army and Navy hospitals—and sites for them—all over the country and in taking counsel with Bell System companies about both general



Walter S. Gifford

Burton A. Hollingsworth

Donald S. Bridgman

Austin Bailey

Judson S. Bradley

principles and particular services which may contribute to the ease and the satisfaction of the calls which mean so much to the hospitalized servicemen. Mr. Hollingsworth entered the traffic department of the Indiana Bell Telephone Company in 1929, and transferred to the commercial department in 1931, where he served in various capacities. In 1942, while he was district commercial manager in Muncie, he moved east to join the sales and servicing section of the A. T. & T. Company's O. & E. Department.

PRIDE and gratitude must be the emotions of Bell System men and women on the home front toward *all* their colleagues in the armed forces. What must be their feelings, then, toward those who by bravery or special achievement have won military recognition and decoration—often at the cost of their lives? Theirs is the story—or as much of it as is possible within the limits of a MAGAZINE article—which DONALD S. BRIDGMAN tells, letting the actual words of the citations speak in sentences more impressive than those which any civilian would be likely to write. Joining the Ohio Bell Telephone Company in 1920, Mr. Bridgman transferred to the A. T. & T. Company a year later. Since then, in the Personnel Relations Department, he has been concerned with technical and staff employment and related personnel matters. Since Pearl Harbor he has worked closely with System companies on the Signal Corps Affiliated Plan and other military service matters. His "Skilled Manpower for the Signal Corps" was published in the September, 1943, issue of this MAGAZINE.

A NATURAL popular interest in war equipment and a good deal of recent indiscriminate advertising have combined to bring about in the public mind a rather general misconception of what is included in the word *electronics*. Far from being some recent and spectacular discovery, the science of electronics is an old acquaintance of telephone people—as AUSTIN BAILEY makes easily understandable in this issue.

Before joining the Bell System in 1922 he had acquired both A.B. and Ph.D. degrees, and experience in the Signal Corps in the last World War, in private industry, and as a college professor. Since then he has been a member of the Departments of Development & Research and Operation & Engineering of the A. T. & T. Co., and of the Bell Telephone Laboratories, and spent a year in England and Scotland in connection with establishing the first commercial transatlantic radio telephone circuit. He is regularly concerned with the technical aspects of numerous radio projects.

(*Continued on page 208*)

THEIR first and quickest link with home and family: telephone service in Army and Navy hospitals for returned servicemen. The expressions on the faces of these men, as they place their calls with the telephone company attendants and wait for the connections to be established, tell something of the emotion with which they wait to hear the voices of their loved ones. See "I Knew Then I Was Home," which begins on page 147

Furnishing the Best Telephone Service in the World Is A Joint Responsibility, the Head of the Bell System Tells The Independent Telephone Association

An Address

before the United States Independent Telephone Association

Walter S. Gifford

I LIKE the thought that must have prompted the United States Independent Telephone Association to invite the President of the American Telephone and Telegraph Company to address its annual meeting. You and we of the Bell System are jointly responsible for the fact that our great country has the best telephone service in the world and we cannot do otherwise than help further this coöperative undertaking by exchanging ideas freely. I therefore appreciate the invitation and I am most happy to be here.

It is customary for a speaker situated as I am to picture the virtues of the audience and praise its achievements. And this I can do with the greatest sincerity. But I cannot do it in a disinterested manner, for except for the members of the Association there is no one more deeply interested in your success than I am. In the first place, I have a pride in the service the telephone industry as a whole renders the people of the United States. In the second place, I have great confidence in the relationships of your group and the Bell System in rendering this service because the relationships have grown up naturally and are based on long experience. And in the third place, you as well as we in the Bell System are always searching for better ways to do the telephone job and thereby stimulating progress in the whole industry.

As the Telegraph Centennial this year has reminded us, the era of successful electrical communication began just a hundred years ago when Samuel F. B. Morse tapped out the first telegraph message from Washington to Baltimore.

It is a curious coincidence that early

This is the text of an address before the annual convention of the U. S. Independent Telephone Association in Chicago on October 11, 1944.

in 1844, just a few months before Morse sent his message, the United States Commissioner of Patents (Henry H. Ellsworth) had said:

"The advancement of the arts from year to year taxes our credulity and seems to presage the arrival of that period when human improvement must end."

Not only Morse's achievement, but the whole course of the communications industry in the hundred years since then would confound the Commissioner if he were alive today.

The Philosophic Approach

RALPH WALDO EMERSON, who was not a scientist but a philosopher, had a shrewder appreciation of the scientific revolution of the 19th century. About five years before the telephone was invented he noted in his journal, "In my lifetime have been wrought five miracles . . . which have altered the relations of nations to each other." One of the five was the telegraph—the others were the steamboat, the railroad, the photograph, and the application of the spectroscope to astronomy.

We can be pretty sure that if Emerson had made this notation in his journal after the invention of the telephone, instead of before, he would have included the telephone along with the telegraph as one of his miracles. Notice also that to him the significance of all these developments was not in the technical achievements they represented, but in the fact that they had "altered the relations of nations to each other." In other words, he was interested in their use and in the tremendous effect of their use upon the world.

The need to communicate with others is one of the instinctive needs of man. Yet up until the time when electricity was first successfully employed to carry men's messages, astonishingly little had been accomplished to speed the process. Broadly speaking, the methods of thousands of years ago were also the methods of one hundred years ago. Any message that had to go a great distance had to be carried. True enough, there were ways of relaying signals—through the beating of drums, the flash of blinkers, the sending of smoke signals, the use of semaphores, and the like. All these systems, however, were limited in scope. The runner at Marathon still had his counterpart, more than two thousand years later, in the riders of the Pony Express. Communication was hinged to transportation, and the acceleration of communications was dependent on progress in transportation.

IN OUR own history there are famous instances, familiar to all, of what delays in communication could mean. On December 24, 1814, the Treaty of Ghent, ending the War of 1812, was signed. However, news of the event had to be carried by a sailing vessel and did not reach the United States until the following February. Meanwhile, many lives had been needlessly sacrificed in the bitterly contested battle of New Orleans, fought on January 8, 1815.

Before the invention of the steam locomotive, transportation, and hence communication, was far from rapid. It has been said that in the 18th century "it took as long to travel by land from Charleston, South Carolina, to Boston as to cross the ocean to Europe, nor was the journey less

dangerous," and that meant more than two months.

As explorers and settlers moved westward, these conditions were repeated in vast areas fronting the Pacific. For some time the only land communication with regions on the west coast was by Overland Mail stages and later by Pony Express. During debate in Congress as to whether the Oregon country was to be brought under the American flag, one nay-sayer objected that it would take a Congressman from that section half of his two-year term in getting to Washington, and the other half in getting back. That may have been a slight exaggeration, for purposes of debate, but it does help to dramatize the communication situation that existed before electricity came to the rescue.

AFTER this long history of slow progress, it seems almost as if the advent of electrical communication had released a long pent-up wish of man which had been intensified through the centuries. Ever since the basic means of transmitting words and speech electrically were first established, more and more use has been made of them; and the continuous search for facilities and methods to increase the availability and speed of world communications has been fully justified by the eagerness of mankind to use each practical new development.

There is no reason to suppose that people will change in this respect. Because the progress of the telephone industry is founded on a basic human need, we have every ground for thinking that the years ahead will give as much opportunity for achievement as have the years since the telephone was invented. On the technical side, as a matter of fact, we already have useful new knowledge which we are only awaiting the end of the war to apply. Developments in the art present and will continue to present new opportunities.

Our Common Problems

BUT IF WE have our opportunities, we also have our problems. Let us consider, for example, some of the problems we face as competitors with other industries.

Because two telephone systems in the same town are a nuisance and costly to the telephone user, practically all such duplication has been eliminated, and it is generally supposed that there is no competition in the telephone industry. However, although competition in the ordinary sense of the word does not exist within the industry, there is plenty of competition to spur the industry on. Apart from the most obvious forms of competition with the telegraph and the mail, the industry competes with all other industries for labor, for management, for capital, and for its share of the consumer's dollar.

If the telephone industry is to continue to be successful and to grow, it must continue to be an attractive industry to work in—young men and young women must feel that it offers an opportunity for a good living with agreeable working conditions and for advancement if merited. In this respect the telephone industry competes with all industry and it is vital that it keep well out in front in its appeal to labor if it is to continue to be successful.

Next, as to management, one of

the quickest ways for the industry to become moribund is to fail to offer to management equal or better opportunities than any other industry. Why should a free American citizen who has the ability to manage a telephone company, or a department of it, choose to stay in that job when some other industry offers more? I realize that there is a real intangible appeal in the telephone industry besides the appeal of financial reward. However, in a private industry such as the telephone, I believe that in the long run the management jobs must pay what other successful industries pay; otherwise, the telephone industry will ultimately suffer—and suffer severely.

The Need for a Fair Return

WE MUST likewise compete for new capital as it becomes needed. To furnish telephone service requires a lot of physical equipment which must be paid for—thus the capital requirements are heavy and every added telephone means still more capital investment. The telephone business must earn, year in and year out, enough so that those with capital to invest will want to put it into this industry. Certainly here we have lively competition for the investor's dollar; and right here we are confronted with the problem of regulation. Prices for telephone service are very properly regulated, but they must be adequate to pay all the costs involved in giving good service. These costs include, besides wages, salaries, taxes, depreciation and other expenses, the return on investment. We in the industry must convince regulatory bodies that it is against the public interest, and against the interest of the telephone users in particular, to be so niggardly on this question of return that the financial soundness of the industry and its ability to secure the necessary funds for investment are weakened. Certainly we can't succeed unless our earnings are comparable to those of other industries. This applies not only to the larger telephone companies but also to those companies where the manager and owner is one and the same. The telephone industry belongs to Main Street. It depends for its equity capital upon the people of moderate income who are looking for a sound investment. It is widely owned. There are over 660,000 stockholders of the American Telephone and Telegraph Company, with no stockholder owning as much as one-half of one percent of the total stock, and there are many thousands of stockholders and owners of other telephone companies. This widespread public ownership, including as it does many tens of thousands of employee stockholders and owners, seems to me an added reason why a niggardly attitude by regulatory commissions on rate of return would be against the public interest.

FORTUNATELY, by and large, telephone service is worth a great deal more than it costs. And the effect of being able to give a service that is worth more than it costs is to keep the business in a healthy state of growth. This in turn has helped the standing of the industry with investors. Of course, the reason why the service is worth so much more than it costs is that service has been improved and at the same time costs

have been reduced through the efficiency and skill of employees and through able management and through scientific research.

Our Rural Customers

THERE is one group of telephone users, however, that it is difficult to furnish with telephone service at a price that the customer feels he can pay. I refer to rural telephone service. Here we have great distances to be covered with few customers. Not only the construction required but the maintenance of equipment makes it difficult always to bring the cost down so that the farmer, unless he is a fairly prosperous one, will cheerfully pay the price. Too many of them decide to do without the service. I say this in spite of the fact that rural telephone service is undoubtedly more highly developed in this country than anywhere else in the world. The point is that it is not developed as far as we in the industry would like to have it. As a post-war objective, I suggest that the entire industry unite on the problem of finding ways and means to furnish satisfactory telephone service for the farmer at a cost that more of them can afford. Fortunately, there are developments in sight that make it look as if this could be done.

We have long recognized that because we deal with men's messages, which are the expression of men's thoughts and often of their most important and urgent needs, we occupy an unusual position of public trust. There is a type of telephone business which I am sure all of us will agree we do not want; that is the telephone business that comes from book-makers or others who use their telephones for an illegal purpose. However, I am sure I speak for the entire industry when I say that we feel strongly that it would not be in the public interest for telephone companies to establish a censorship over millions of telephone conversations in order to prevent such use of the service. There is traditionally a confidential relationship between the employees of the telephone company and its customers that it could not possibly be in the public interest to destroy. The regulatory laws under which the telephone companies operate recognize this. They contain many provisions to insure privacy in communications by telephone and they require the companies to give service without discrimination. It is one thing to cooperate with law enforcement agencies by discontinuing telephone service immediately at any address where law enforcement authorities tell us that the service is being used for an illegal purpose; it is quite another thing and, I believe, in the public's point of view a dangerous thing, for us to assume the function of law enforcement itself.

I HAVE referred to our position of public trust and to the tradition which keeps the relationship between the employees of the telephone company and its customers a confidential one. It is a vital principle of our business that telephone men and women do not listen in on conversations and divulge them to others. This brings me to a matter that may turn out to be of real concern to the entire industry. The war has stimulated the use of devices by which telephone conversations are recorded. There are a number of perfectly legitimate uses for

such recordings. If, however, such a practice should become universal, it seems to me it would completely change the character of telephone communications and would be against the public interest. When a person telephones, he very properly expects his conversation to be private. I think consideration should be given to ways and means by which the legitimate use of such recording devices may be continued but all other use discouraged. Some method that would put the unsuspecting telephone user on notice that his conversation was being recorded might perhaps be the answer.

The Test of War

I HAVE mentioned a few of the problems our industry faces. There could be no better ground for assurance that we will meet these and other problems successfully than the industry's record of achievement in meeting the supreme test of war. After what has been done in the last few years, it seems to me we ought to have a lot of confidence in our ability to take on whatever comes next.

In reviewing the war job, I think I can put the essence of the telephone industry's accomplishment in a very few words. We in the industry were and are the custodians of a service absolutely vital to successful conduct of the war. The American people looked to us to provide, on short notice, a greater quantity of swift and reliable telephone communication than had ever been provided before. We have delivered that service, and we shall continue to do so.

Today the telephone industry is serving some 26,500,000 telephones in the United States, or about 5,000,000 more than in 1940, when the national defense effort began. But that is only the broad background of the wartime picture. Let me sketch in a few of the high lights, very briefly.

Of first importance are our services to the Army and Navy and other war agencies. In the last few years service has been provided, usually on a rush basis, to approximately 3,300 camps, bases, arsenals, shipyards and Government-financed war plants. Many of these establishments are of vast size and many are located in cornfields or other remote areas, so that it was necessary to build the telephone facilities from the ground up. In doing this, time was of the essence, and telephone people worked day and night to speed construction of connecting lines, to build and install PBX and station equipment, and to enlarge or build new central offices in record time.

NOT A FEW important toll construction projects were also rushed through expressly or primarily for war purposes. Thousands of miles of private-line telephone and teletypewriter networks were laid out to serve the armed forces. Extensive and flexible facilities were established time and again for the maneuvers of armies in training. Jointly with the armed forces and civilian defense authorities, the telephone industry assisted in creating this country's air-raid warning system—the first line of defense against enemy attack. Many of our land communication lines, together with our overseas radio telephone facilities, form a vital and integral part of the world-wide military communication system which coördi-

nates America's war enterprise over the whole face of the earth.

ALL THIS was in addition to the job of giving good telephone service to the privately- and government-owned war industries of the nation, which likewise required an enormous increase in the communication facilities at their disposal. This over-all demand was reflected most clearly in the spectacular increase of toll and especially long distance service. In three years' time the volume of traffic over the longer routes more than tripled, the growth of long distance in the war period almost equaling the entire previous growth through a period of more than half a century. In handling this enormous volume of business, telephone plant has been overloaded and not every call has gone through as quickly as we would like. Nevertheless, important calls have been promptly put through and the average speed of service on all calls has been well maintained considering the extreme difficulties which we have had to face and are still facing. Only a small proportion of all long-haul calls—about seven percent—have required more than ten minutes to complete. This record shows that when the nation turned to the telephone for speed, the telephone industry delivered the service that helped to deliver the goods.

The problem was not merely to meet all essential needs for telephone service, but to meet them during a time when shortages of materials were becoming progressively more acute. Anticipating severe shortages of materials needed for war, the telephone industry voluntarily put into effect a broad conservation program which included substitution of less critical for more critical materials throughout the telephone plant. When the time came for the application and administration of Government orders framed to promote the utmost conservation of materials and manpower, the industry had already gained an experience which has been of great value in enabling us to cooperate most effectively in the Government's program.

Progress made in past years, plus resourcefulness in the pinch, have brought about this two-fold result: the telephone service the nation needs is being rendered, *and* the materials that had to be saved have been saved. Thanks largely to the development of modern telephone carrier systems, millions of miles of toll and long distance circuits have been provided—not all we need, to be sure, but a large amount nevertheless. In particular, the emergency narrow-band carrier channels which we have been able to establish—virtually making two circuits grow where one grew before—have added immensely to our long distance circuits. These circuits have given acceptable service to war-time users without requiring appreciable expenditure of materials. A system of priorities on toll calls established by the Board of War Communications has been effectively administered and has helped to insure swift transmission of important war calls.

Meeting Service Men's Needs

AN IMPORTANT phase of the telephone industry's war job is to enable members of the armed forces to make the personal calls which mean so much to them and to their families and friends at home. The entire in-

dustry has done and is doing its utmost to provide service that will be as convenient, personal, and friendly as it is possible to make it. To that end attended telephone centers have been established at hundreds of camps, bases, and hospitals, as well as at many other locations where service men and women congregate. Camp telephone managers and public telephone people are doing everything in their power to minister to the comfort and convenience of all members of the fighting forces who look to them for help. Attendants and operators who handle the calls are eager to render service that will be as distinguished for its sympathetic human quality as for its technical excellence. Engineers are alert to provide the best physical arrangements that can be devised, as for example at military and naval hospitals, where special equipment is often needed for the convenience of wounded or convalescent patients.

Army and Navy authorities from the begining have understood the importance of these efforts and have given us their most helpful and welcome coöperation. I don't think we can possibly overestimate the value of this job, or the extent to which the men and women who use the service appreciate it. And I am very sure that every one of us in the industry regards this assignment as not merely a responsibility but a privilege of the highest order.

Manifesting a Fine Spirit

IT SEEMS to me also that the spirit shown on this assignment reflects the fine spirit of courtesy and helpfulness that telephone people throughout the industry have demonstrated in the face of all war-time difficulties. There are a lot of things that I take pride in as a telephone man. There is nothing I am more proud of than to be a member of a group of people who have kept their heads, their tempers, and their good manners. Telephone employees have been confronted by any number of harassing problems. They have had countless rush jobs to perform. They have had more calls to put through than the facilities available were designed to handle. They have had the difficult job, over and over again, of saying "No" to customers. They have had to master all kinds of complex administrative details. They have had to exert all their ingenuity and, at the same time, all their patience. They have done all these things and they have not for one moment slackened in their wish or their ability to render genuinely helpful, courteous service.

THIS achievement has not gone unnoticed by the American people and I do not believe I am exaggerating when I say that the example of a great service industry continuing to give service with courtesy as well as with competence all through these war years has been a great national asset.

The results which have been achieved could not possibly have been brought about except by the ready cooperation of all concerned, including your group and the Bell units in the industry, the Government groups in Washington charged with war-time administrative responsibilities, and, last but not least, the American people, who have been widely informed of the industry's problems and have

demonstrated their understanding, their patience, and their willingness to help. The spirit of coöperation within the industry has never been better exemplified than in the work of the joint industry committee which has patiently and thoroughly studied our common problems and has made, in my judgment, the most practical recommendations that could have been made to the responsible administrative agencies of the Government.

The present extreme shortage of local facilities for civilian use, as demand for telephone service continues to increase, is the direct result of another vital war job which has been largely entrusted to our industry. I refer to the production of electronic and communication equipment for the fighting forces, in which all manufacturing units of the industry are now or have been deeply engaged. The science behind electrical communication lies at the very heart of modern war; the knowledge of telephone scientists and engineers and the manufacturing skills that we have acquired are indispensable resources, and are directly responsible for the production, in huge quantity, of many of the indispensable tools of victory.

A "Telephone-run" War

THIS is a telephone-run war, from the production plants up to the front lines, on land, on sea, and in the air.

The radio telephone, according to one expert on naval affairs, has brought about a complete change in the conduct of naval war. That is largely because the sea commander can now dispose his forces wherever he chooses across the broad area of battle, summoning them together for sudden attacks. Using short-range voice radio, he can do this without being overheard by the enemy. The famous message, "Scratch one flattop!" from a Navy pilot to his carrier in the Coral Sea, was a message for which many others had helped to pave the way. And at the decisive battle of Midway, where we turned back the Jap threat to Hawaii, it was by radio telephone that Admiral Spruance summoned planes from all quarters to pour it on the Jap fleet.

In land warfare, where battles are planned and fought at closer quarters, wire lines are still the basic and indispensable means of communication. The nearer the battle line, the more necessary the wire. "For secret, heart-to-heart military confabs," said a newspaper report from General Bradley's headquarters in France, "wire, exchange operators, and the human voice still must be relied upon. General Bradley has a group of the best telephone construction engineers in the world to keep his telephone communication going whenever he moves ahead to maintain contact with his advancing forces. . . . The faster the corps moves forward, the faster their telephone lines must be lengthened, and when the troops are slashing forward swiftly the wires have to keep up with them also."

DO YOU remember the time when General Eisenhower jokingly asked General Patton, "Why don't you get the lead out of your feet?" One of the remarkable things about this question was that General Eisenhower was able to voice it *over the telephone* to a tank commander moving ahead as fast as his tanks could roll.

During the first 22 days of the invasion of Italy, American Signal

Corps units laid more than 5,300 miles of assault wire, field wire, and cable. I could give many other facts illustrating the essential part played by the telephone—in observing and correcting artillery fire, for example—but I am sure you fully understand and appreciate it. To all of us here the subject is especially important. Many of the men responsible for the success of combat communications are members of our telephone family who were ready and equipped with telephone "know how" when the call came to them. Our industry is supplying huge amounts of the equipment used. And finally, it is we who at all times, in peace as well as in war, have the responsibility for developing and bringing to the highest possible level an art which is so vital to the nation in time of crisis.

The contributions of the research and manufacturing branches of the telephone industry to the successful prosecution of the war have by no means been limited to communications. The development of special radar and other electronic equipment and its manufacture have been outstanding achievements. In fact, the industry has been the largest producer of electronic equipment in the United States, besides being the largest producer of war communication equipment.

Meanwhile, as we plug hard at our job, more than 70,000 members of the telephone team have joined the armed forces. That is not part of our contribution to the war; it is their own contribution. But from them we draw our deepest inspiration; what they are doing intensifies our resolve to do everything we possibly can to help them get home quickly. We look forward with eagerness to the time when we can welcome them back as active members of the telephone family—and that time cannot come too soon.

IN SPEAKING as I have of the telephone industry's war record, and its ability to overcome great difficulties, I have had two thoughts in mind. One, as I have already indicated, is simply that while there are most assuredly a lot of hard jobs ahead of us—some of them perhaps harder than any we have yet faced—we have learned much that is of permanent value and we ought to be able to tackle the future with confidence.

The other thought is that the overall war job of our industry is only the sum of hundreds of thousands of jobs that telephone men and women have so ably performed as individuals. In all branches of all organizations in the industry, the people who *are* the industry have dedicated their spirit of service, as well as their skills of head and hand, to the great task that is theirs. This spirit will, I am sure, be the priceless asset of the future, as it is of the present.

Public Telephones for Returning Servicemen in Army and Navy Hospitals Are Appreciated as a Convenience by the Men and as a Morale Builder by Medical Officers

"I Knew Then I Was Home"

Burton A. Hollingsworth

DOWN the long corridor of an Army hospital located near the east coast of this country marches a column of soldiers. Their steps are slow and their boyish faces are tired and worn. They have just disembarked from a hospital train. They know that after a few minutes in the hospital's receiving room they will at last be at liberty to rest. They have been on the move ten days since they left a base hospital in Europe—ten days in motor transports, ships, trains and ambulances.

As they pass the PX, one of them cries out, "Gee—malted milk and ice cream!" A moment later another exclaims, "Boy, look—telephones!" Two drop their baggage, break ranks, and make for the attended telephone center. The officer in charge, realizing that this is the first opportunity these men have had in nearly two years to talk with loved ones, disregards the irregularity and permits the whole group to "fall out." They swarm into the center. It buzzes with activity.

Excited, anxious faces crowd around the counter and ask the telephone attendant for numbers in Pittsburgh, Kokomo, Waycross, San Francisco, Castine. Excited, anxious voices fairly shout to parents and wives who have waited months to hear, "It's me, it's Bill, I'm back!" One sees a variety of emotions as they place their calls. Some joke and chide one another, others are more serious, some nervously bite their lips, others ask questions in short, jerky spurts: "Could I call next door and ask them to get my father?" "You're sure the operator can get our new phone number?" "How long will it take to get Birmingham?" Several times the attendants have to start conversations for men too emotionally upset to talk when members of their families answer the calls. Or they console boys who hear for the first time of tragedies which have occurred during their absence.

This is an actual occurrence, but it is only one of hundreds. Scenes like it are being enacted in Army and Navy Hospitals all over the country whenever such groups of men first arrive back in the United States.

Men, wounded in mind and body, are being returned to establishments far from the battle fronts for convalescence under the finest medical and rehabilitation facilities in the world. Many are brought back by ship; some are flown directly from field shelters behind the lines, arriving only a few days following their injuries; some have already been in overseas hospitals for weeks.

THANKS to modern therapy, most of the men suffering from even the severest wounds will be rehabilitated and enabled to lead lives of normal activity. But the most modern medical and psychiatric care, the finest surgery and appliances, expert rehabilitation, vocational training, and employment opportunities are far from being all that is needed by men who have suffered disfigurements and disabilities. If a young man returns from combat with a disfigurement or other serious disability—whether deafness, blindness, a shattered body, an amputation, or burns—he is almost certain to be emotionally disturbed. The most serious wound he brings back may be mental. It is only natural that maimed young men should think bitter thoughts, lose their self-confidence.

And yet, in case after case these men have been freed from their black thoughts and bitterness and have had their self-confidence restored by the expert rehabilitation treatment they have received, as soon as possible after injury, in Army and Navy hospitals. In all of these establishments, the restoration of self-confidence as an aid in the restoration of physical health is the immediate aim of doctors, nurses, and other personnel.

Almost without exception, the boys upon their return to this country ask first for favorite foods which they have missed, such as malted milk, fried chicken, and watermelon; and for the opportunity to talk with their families at home.

Medical officers in both the Army and Navy feel that the improved mental attitude which is noticeable in patients after they have called their families is an important factor in the treatment of these men. The commanding officer of one large Army general hospital, in writing to the telephone company, said: ". . . one must see our patients when they arrive, then observe them after they have completed their call to the folks back home, to realize what prompt and efficient telephone service means to men who have been overseas from a year and a half to two years. From the standpoint of morale of the fathers, mothers, and soldiers I can think of no finer service. . . ."

Appropriate Arrangements

MANY FACTORS have a bearing on the particular telephone arrangements which are most appropriate for a given establishment and the men who are hospitalized there. Among them are such matters as the degree and kind of the men's disabilities, the location and layout of the hospital, where the majority of the men's homes are situated, and the telephone requirements of personnel other than patients. In the larger Army and Navy hospitals throughout the country, the provision of attended service in telephone centers and of bedside service for men who are confined to bed, under the general supervision of

a telephone man assigned as "telephone manager," meets adequately and conveniently the telephone needs of hospitalized men.

The attended telephone centers, so situated as to be accessible to all ambulatory patients, even those on crutches and in wheel chairs, have become popular meeting places. Behind the counters in these centers are telephone company attendants to take the calls and put them through as fast as crowded circuits will allow. The selection and training of women for this type of work is of utmost importance. Dealing with men with physical handicaps, often with nervous manifestations, requires an unusual amount of patience, judgment, and sympathetic understanding.

Telephone attendants play a daily part in the rehabilitation program. They are not only called upon to render many unusual services to patients, but are also faced with the important task of dealing with them in such manner that they will not incite self-pity nor in any way hamper from a psychological standpoint the rehabilitation which is being carried on by Army and Navy authorities.

COMFORTABLE FURNISHINGS, and magazines, stationery, and a cordial greeting and friendly atmosphere make waiting for their calls at attended locations no hardship for patients in Army and Navy hospitals

Even though a disabled soldier or sailor be surrounded with sympathy, waited on hand and foot and given countless attentions, he may still despair. He may still view himself as

a martyr—an attitude which brings little happiness to him or to anybody else. If his faith in his ability to do things is restored, the rest of the treatment is easier. The telephone representatives in a hospital find many opportunities to contribute to restoring patients' self-confidence.

A YOUNG BOY whose wounds had necessitated the amputation of both legs was so conscious of his handicap that he refused to leave the ward. Although physically able to do so in a wheel chair, he flatly refused to attend entertainments, go to the mess hall, or avail himself of any of the recreational facilities which were available. Finally, after much persuasion, a Red Cross worker got him to go to the Red Cross recreational building. While there, he noticed the attended telephone center which is adjacent to it. He ventured up to the door and peered timidly in. One of the attendants saw him and called, "Come on in, soldier," but he turned his chair and went away without answering.

Within a half-hour the attendant again noticed the same boy looking in, so she went to him and asked if he wouldn't like to call home. She pointed out that in the center there was a booth large enough so that he could roll his chair inside, close the door, and have all the privacy he desired. She said, "Just tell me where you want to call, go in the booth, and I'll do the rest." The desire to call home won out, and he went into the booth and was soon talking with his parents. From then on, he was a different boy. He started going about, found new friends all over the hospital, became interested in a hobby, and made frequent calls home—all of which contributed substantially to improving his condition.

Special facilities have been devised for the comfort and convenience of patients, and often use of them results in unusual and interesting experiences. For example, let's take Tony. Tony came back with both arms off just below the shoulder, and had recently been fitted with artificial arms. He found his way to the telephone center one day and an attendant, realizing that Tony would have difficulty in using a regular telephone, mentioned that there was a head set and chest transmitter in the center and that she would be glad to adjust this equipment so that he could place his call and talk without the necessity of holding a telephone.

Tony, however, was looking to the future. He said, "You know, when I get out of this hospital I'm going to have to learn how to do lots of things for myself, and I think one of them will be to use a telephone. If you will hold a telephone for me for just a minute, until I get the feel of the thing, I might just as well start learning now." After a few minutes of experimenting, both in picking up and in holding the telephone, Tony said, "O.K. Get me Morgantown, West Virginia, please, and watch me go to town." Tony talked for ten minutes on that call, and his new-found pleasure resulted in his becoming a regular patron.

A Link with Home

THE telephone centers are comfortable, friendly, cheerful places and seem to help the man to relax. The out-of-town telephone directory rack is the scene of much activity. It's not

uncommon to see a newly arrived man dash for the rack and hurriedly leaf through the pages of some directory. Perhaps there isn't even a telephone at his home, but it's mighty good to locate the names and addresses of neighbors and friends. Telephone directories placed on a low shelf, so that wheel chair patients needn't ask help in consulting them, are helpful in teaching the men self-reliance.

SPECIALLY CONSTRUCTED booths, large enough to admit patients in wheelchairs or on litters, and with doors designed so that patients may open and close them without assistance, are a much appreciated feature in hospitals

Hospital authorities prefer that men do as many things for themselves as possible, as it helps them to rebuild their strength and self-confidence. The over-sized telephone booths have been designed with this in mind; and these and doors which may be opened and closed by pull cords by the patients themselves meet with the hearty approval of both authorities and patients. The large booths are usually equipped with seats which swing out of the way, head sets and chest transmitters, regular telephone sets, and amplifying equipment for use by men with impaired hearing. Many of them are large enough to accomodate a man on a litter. Thus the special equipment is available for use by any patient, regardless of his injury.

Booths without seats are provided for men whose crutches or casts make sitting impossible or, at best,

difficult. Hooks are installed in these booths upon which men may hang their crutches.

Convalescing men seldom feel like standing in line or leaning against a wall when delays in their calls necessitate waiting. To make the telephone centers more homelike, comfortable furniture, and such things as magazines, newspapers, and stationery, are furnished so that men while waiting may read, smoke, write letters, and lounge at ease. Booklets describing and picturing the hospital are of special interest to the patients and many of them are mailed home as souvenirs. At holiday times, the room is appropriately decorated and the attendants help the men get into the spirit of the occasion by serving candy, nuts, pop corn, soft drinks, or whatever refreshments may be timely for the occasion.

The attendants all take personal interest in seeing that the men's calls get through. One girl actually talked a garage man in a small town into rowing three miles across a river to bring back the mother of a boy who wanted to talk to her. Police stations, sheriffs' offices, ration boards, town post offices—all of these have been asked to help in tracing folks who have moved or have had their telephones disconnected.

All one boy knew was that his wife had moved in with another girl in an apartment house and that he wanted to talk with her. As it was not a large town, the attendant checked with the local operator and found that there were three apartment houses in the town; so she called each one of them. The superintendent in the third house inquired, "Is she the woman with twins?" She was, and within a few minutes the year-old twins and Mother were all trying to talk at the same time.

Perhaps the patients who get the greatest lift from the use of a telephone are those who are confined to bed. These boys, due to the nature of their injuries, are unable to enjoy most of the recreational facilities provided in the hospital; and many a patient shows marked mental and even physical improvement when arrangements are made for him to place a telephone call to his family while still flat on his back.

Providing Bedside Service

BEDSIDE SERVICE is provided over extensions from the attended center, which terminate in jacks suitably placed in the wards. Nurses or telephone company attendants, usually girls wearing uniforms or some other means of identification, deliver portable telephones, which plug into a near-by jack, to the bed patients when they want to place calls. On their trips through the wards, the attendants look up telephone numbers, assist in filing the calls, explain the classifications of long distance service, and furnish rate information.

In one ward, the men were being entertained on one occasion by a pianist and a girl singing popular songs. It happened that one of the boys who had both arms in casts knew that the only time he could reach his wife was during the time the program was in progress. When the telephone was brought to his bedside by the attendant and the call was established, other patients saw the attendant hold the telephone instrument for him with one hand and hold one

finger of her other hand in his ear to block out the room noise.

Another patient, whose leg was very seriously injured, was considered by the doctors to be in such a condition that recovery was unlikely. He showed little interest one way or the other. When jacks were installed in his ward and the selection of the first man to make a call from bed was being considered, the surgeon in charge suggested that he be chosen, in the hope that talking with his wife might change his mental outlook sufficiently to influence his physical recovery. Because of the seriousness of his condition, his wife was called and informed in advance of the conditions under which her husband would make the call. After this first telephone visit with his wife, the patient's condition improved so much that he was soon out of danger. Ward bedside service means much to him now, as evidenced by his one or two calls each week to his home.

NURSES or telephone company attendants, the latter usually wearing uniforms or some other means of identification, deliver portable telephones to bed patients, and help them with the details of or information about their calls if they should need assistance

Men who are flown directly from the European battle fronts to hospitals in this country often arrive as soon as the fifth day after they are injured, and sometimes their families have not yet been notified of their

wounds. Naturally, it is one of the first desires of these men to call home, and hospital authorities feel that bedside telephone service is one of the essential features in the operation of such a receiving hospital.

Usually these men are much more worried about how their mothers, wives, or sweethearts will take the news of their injury than they are about their own condition. "How will I tell Mary I've lost a foot?" is a familiar question to the hospital telephone attendant. "Should I hold her to our engagement, made a year ago?"

One young flier who had lost a leg was very hesitant to tell his wife about his loss because he was uncertain what her reaction might be when she learned that he would be permanently crippled. He finally decided to call her and tell her of his arrival, and arranged for her to visit him at the hospital as soon as she could do so. She arrived a few days later, and when the patient was assured that his wife, overjoyed at his return, was more than willing to help him overcome the handicap, his mind was so relieved that he responded much more favorably to treatment by the medical authorities.

Telephone Managers

TELEPHONE MANAGERS have been assigned to the larger hospitals to keep abreast of the requirements of the men and to provide a direct day-to-day contact between the telephone companies and the hospital authorities. The managers function along the lines of the camp managers in military and naval camps and bases.* They make sure that the most convenient telephone arrangements are provided at the right places, in the right amounts, and of the right kind. As men improve and gain strength enough to be out of bed part of the time, or as they are released and new groups arrive, the requirements for different types of telephone equipment may change, and the telephone manager is on the job to see that the necessary changes are made promptly.

Telephone managers spend a great deal of their time talking with the patients as they gather in the attended center, and in visiting with the men who are confined to their beds. Their friendly, helpful attitude often enables them to help patients with mental and physical handicaps get things straightened out so that the world looks brighter to them.

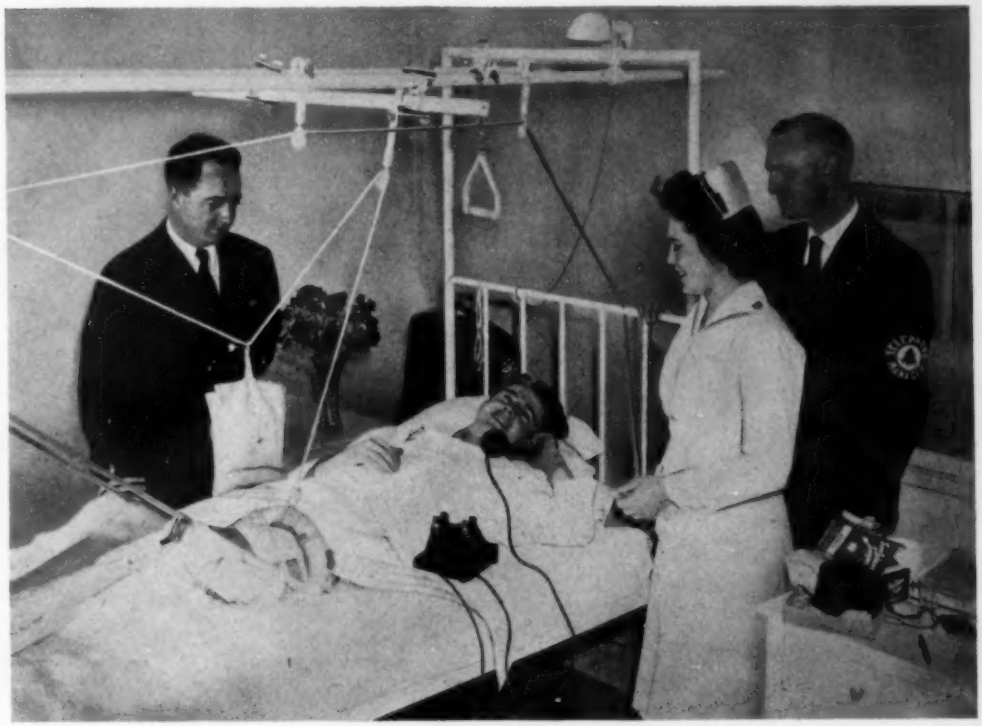
For instance, the big 220-lb. 19-year-old, whose legs had been badly shot up, had given up entirely. In spite of many operations, his improvement was so slow that he didn't much care whether he got well or not. He was morose, refused to coöperate with doctors or nurses, and ignored other patients. The telephone manager put this boy on his daily schedule for a visit.

It was a month or so before the patient warmed up to these visits, but gradually he came to look forward to them, and a friendship grew between the two which enabled the manager to learn much of the boy's background. It developed that he hadn't called or written to his mother. The manager finally, after much persuasion, prevailed upon him to call her. According to the hospital authorities, that call was the turning point. The boy soon arranged for

* See "Service for Service Men," MAGAZINE, February, 1943.

his mother to come and visit him, and from then on he showed marked improvement and, as the manager said, "He became my assistant manager."

The telephone companies offer deferred payment arrangements whereby the men can go ahead with their calls and, if they wish, pay for them later at their convenience. This feature of the service is made known to the patients by means of notices and pamphlets which are given them upon their arrival and posters displayed throughout the hospitals. Of course, many patients place their calls "collect," so that charges are billed to the called telephone. Also, in many of the hospitals, newspapers, employee groups, businessmen's clubs, or similar organizations have sponsored funds which are used to pay for one call anywhere in the United States for each service man returned from active combat duty.



TELEPHONE MANAGERS spend much of their time talking with patients at the attended center and visiting those who are confined to bed. Their helpfulness not only in the matter of telephone calls but with an occasional personal problem often contributes greatly toward recovery

Meeting the urgent and special telephone requirements of men returned to this country for hospitalization by arranging telephone equipment so that it is convenient and

pleasant for them to use, regardless of their physical condition, has been looked upon by the telephone companies as one of the most important jobs they have tackled during the war—and one of the most satisfying in its accomplishment.

Most of the operating companies of the Bell System have in their territories one or more Army or Navy hospitals, and are providing in general the kinds of service here described for the men hospitalized in them. That these services are sincerely appreciated by the men is attested by their use of them. That they are so much used, and that they prove both pleasing and convenient, comes about because each of the companies has not only adopted a comprehensive program for service at such hospitals but has studied carefully the layout of the individual institution and the probable needs of the patients in it. Members of the A. T. & T. Company's O. & E. Department have helped too, visiting many of the hospitals and the companies and providing for an interchange of experience and ideas.

The value placed upon this service in hospitals by the military authorities was recently expressed by the Commanding General of the Fourth Service Command, on the occasion of the presentation of the National Security Award to one of the telephone companies. The General said, "One of the Army's greatest obligations today is to our returned wounded personnel, to remake their health and to sustain their spirits, so that we may return them to their communities as good citizens after the war and, so long as it is necessary, return some of them to the battle fronts as good soldiers. In this caring for our wounded, morale is unquestionably of paramount importance. And in the building of morale, the special new telephone equipment which you have installed in many of our hospitals is of immeasurable value. It is appreciated, believe me, by the men, and by the Army."

As to the appreciation felt by the service men themselves, one need only to consider the remark of a young army private recently returned from Sicily who, in answer to a question by the hospital's "Inquiring Photographer," said, "What gave me my biggest thrill when I returned to the States? Out of a hundred things I could think of—American automobiles, American trains, American girls, only one thing thrilled me most. . . . The moment when a telephone operator at the hospital attended location contacted a warm, human, loving voice that said, 'Hello, Son. It's good to hear your voice.' A thrill? It's an understatement. I knew then I was home."

Bravery, Devotion to Duty, Self Sacrifice Are Qualities Exemplified by Telephone Men in the Armed Forces Which Have Been Recognized by a Variety of Awards

For Heroism, Gallantry, or Extraordinary Achievement

Donald S. Bridgman

ON JANUARY 12, 1943, First Lieutenant Weldon S. Sims, former combinationman of the Southern Bell Telephone and Telegraph Company, was killed in action on Guadalcanal Island.

"While his company was pinned to the ground by heavy machine gun fire, Lieutenant Sims volunteered to advance ahead of the lines to secure information concerning the terrain and objectives of the intended advance. Carrying with him communication equipment which rendered effective concealment impossible, he advanced across rugged terrain, swept by rifle, machine gun, and mortar fire, sending back to the battalion commander valuable information which enabled the placement of effective mortar fire upon vital areas. Lieutenant Sims was finally sighted by the enemy and met death from short range machine gun fire. Because of his voluntary action, the troops were inspired to attack and the information he secured greatly facilitated their advance."

This quotation is taken from the citation accompanying the posthumous award of the Distinguished Service Cross "for extraordinary heroism" to Lieutenant Sims by Lieutenant General Millard F. Harmon, commander of the U. S. Army Forces in the South Pacific Area. The Distinguished Service Cross is the highest honor received by a Bell System man in this war, so far as is known, and it has been given to only three other Bell System men in the armed service of their country.

His deed exemplifies the timeless qualities of courage, devotion to duty, and self-sacrifice for one's comrades and one's homeland revealed in men by great crises throughout history. For telephone men and women, it illustrates also the essential value of modern communications in this World War and how their effective use by one valiant man can help to save the lives of many others.

Weldon Sims is one of a shining

LIEUT. WELDON S. SIMS
Distinguished Service Cross (posthumous)
Killed in action

company of Bell System employees now on military leave of absence to whom decorations have been given for outstanding deeds and achievements in the nation's military and naval service as symbols of its gratitude and recognition of unusual bravery and fidelity to duty. Those receiving them prize these decorations as evidence of success in meeting a special challenge but would be the first to claim that their honors are also honors to comrades who, under similar circumstances, would show like daring and determination.

No record of the accomplishments leading to these awards can portray the hardships and suffering incurred. No article of this kind can mention more than a few typical cases for which the different kinds of decorations were given. Frequently, word of an award has come through a story picked up from a local newspaper and, although the System companies make every effort to learn of achievements of their men in service, it is certain that some, perhaps many, decorations have been earned which have not been reported or about which the information is very scanty. In some instances, the Army and Navy have been asked for official citations, and the quotations throughout the article are taken from them. It has been a thrilling assignment to read the accounts which have been secured, and it is hoped that this article can provide for the MAGAZINE's readers some conception of the magnificent things their fellows are doing in all parts of the world.

The types of achievement for

LIEUT. LUTHER G. BREWER
Distinguished Service Cross (posthumous)
Killed in action

which the principal decorations of the armed services are awarded are summarized below in the established order of precedence. Except as noted, they are given by all the services. In time of war, while the Coast Guard serves with the Navy, its members are eligible for Navy decorations.

Medal of Honor (Army)—For gallantry and intrepidity at the risk of life above and beyond the call of duty. Although a different decoration, the Navy Medal of Honor is also its highest award and is given for similar actions.

Distinguished Service Cross (Army)—For extraordinary heroism in military operations against an armed enemy. The corresponding Navy decoration is the *Navy Cross.*

Distinguished Service Medal—For exceptionally meritorious service in a post of great responsibility.

CAPT. LEWIS N. ELLIS
Distinguished Service Cross, Air Medal with three Oak Leaf Clusters, Distinguished Flying Cross
On active duty

SGT. ARTHUR J. O'KEEFE
Distinguished Service Cross
Wounded in action, recovered, honorably discharged, and re-employed by the Wisconsin Telephone Co.

Legion of Merit—For exceptionally meritorious conduct in the performance of outstanding services.

Silver Star—For gallantry in action.

Distinguished Flying Cross—For heroism or extraordinary achievement in aerial flight.

Soldier's Medal (Army)—For heroism not involving actual conflict with an enemy. The *Navy and Marine Corps Medal* is the corresponding decoration in those services.

Bronze Star Medal—For heroic or meritorious service against an enemy not involving aerial flight.

Air Medal—For meritorious achievement in aerial flight.

Purple Heart—For wounds received in action against an enemy.

Members of the Marine Corps may also receive the Brevet Medal awarded for distinguished service in the presence of an enemy and ranked just after the Medal of Honor. No decorations are issued more

than once to any individual. In the Army, Oak Leaf Clusters are added to the original decoration for each succeeding deed meriting such an award. In the Navy, stars are given under similar conditions.

A FEW months after Weldon Sims gave his life in the steaming jungles of Guadalcanal, another Southern Bell man, a junior clerk in the accounting department, earned a D.S.C. at the cost of his life "for extraordinary heroism" in the cold and fog of Attu in the Aleutians. On May 26, 1943, Second Lieutenant Luther G. Brewer's platoon

Distinguished Service Cross

Legion of Merit

"was stopped as it advanced up a precipitous ridge north of Chichagof Valley by a strong enemy machine gun and rifle position. The advantageous location and fortification of the enemy made it imperative that they be reduced before our troops in that sector could move forward. The platoon sergeant and two men were killed as they attempted to knock out the enemy position. In the face of almost certain death Lieutenant Brewer courageously dashed forward alone under withering enemy machine gun and rifle fire to a point within grenade range of the enemy position. Although mortally wounded by enemy fire, Lieutenant Brewer successfully grenaded the enemy until they were destroyed. By his daring and fearless action and the inspiration of his gallantry, Lieutenant Brewer's platoon and other troops moved forward to accomplish their missions."

THE THIRD D.S.C. won by a Bell System man was awarded to First Lieutenant Lewis N. Ellis, also from the Southern Bell, who had been an office manager in the commercial department, "for distinguished service, extraordinary heroism, and gallantry in action" on the initial raid against the Ploesti Oil Refineries in Roumania August 1, 1943.

"On the approach to this strategically vital enemy target, Lieutenant Ellis, pilot of a heavy bombardment aircraft, flew his plane in at an altitude of 200 feet, through a concentrated and deadly curtain of anti-aircraft fire which increased in intensity as he came nearer the objective. At the target itself, Lieutenant Ellis, displaying cool and courageous flying skill, flew his ship directly through columns of smoke and fire in order to drop his bombs on the designated pinpoint. So heavy and accurate was the enemy flak that the left elevator control was shot off, the left elevator itself riddled with bullets, the hydraulic and oxygen systems thrown out of commission, the nose wheel mechanism destroyed, and one of the engines disabled. On leaving the target area after successfully bombing the selected objectives, Lieutenant Ellis' bomber continued to be under fire from enemy ground installations and, furthermore, was subjected to attacks by many enemy pursuits. During a 45-minute running battle, four of his crew members were wounded, and the tail and top turrets were shot out of commission, yet Lieutenant Ellis, by a display of masterly piloting, enabled his gunners

to shoot down one and probably two of the attackers. His skillful and valorous performance of duty, when faced with extreme peril, constitutes heroism and devotion to duty of the rarest kind."

More recently, Ellis, now a Captain, has been awarded the Air Medal, three Oak Leaf Clusters, and the Distinguished Flying Cross for extraordinary achievement as a bomber pilot on flights over continental Europe.

THREE DAYS LATER, under the shadow of Mt. Etna in Sicily, the fourth Bell System man earned his D.S.C. This was Sergeant Arthur J. O'Keefe of the Wisconsin Telephone Company's plant department, who as

"leader of a rifle squad, led a bayonet charge on the company's objective. Although seriously wounded four times, he pressed the attack, his squad being the first to occupy the objective. While waiting to be evacuated, he directed his squad in a successful repulsion of an enemy counter-attack. During this latter action, he was wounded again several times. The extraordinary heroism, determination, perseverance, and aggressive leadership displayed by Sergeant O'Keefe reflect the finest traditions of the Armed Forces and are deserving of the highest praise."

O'Keefe's decoration, for which he was recommended by Lieutenant General George S. Patton, was actually received at a military hospital in this country, to which he was transferred from a hospital in North Africa. After spending eight months recovering from his wounds, he was discharged from the Army and was reëmployed by the Wisconsin company in the plant department.

AWARDS of the Legion of Merit have been reported for twenty-two System employees in the Army and two in the Navy and Marine Corps. Given for "exceptionally meritorious conduct in the performance of outstanding services," these awards generally recognize outstanding performance in the accomplishment of a difficult task requiring weeks or months to complete. Since, for telephone men, exacting assignments frequently have involved the establishment and maintenance of communications, the

Silver Star — Distinguished Flying Cross

majority, but by no means all, of these awards have been for achievements in that field.

Such an achievement under the toughest sort of conditions was that of Corporal Belton K. Vaughan of the Western Electric Company's sales department, who won his Legion of Merit

"while serving with the wire section of a Marine Aircraft Group in the Solomon Islands Area from November 2, 1942, to April 1, 1943. Employed in the construction and maintenance of telephonic commu-

nications for all aviation units on Guadalcanal, Corporal Vaughan, despite Japanese naval bombardment, artillery fire, and bombing raids, repaired with efficient promptness all operational circuits necessary to the effective control of aerial combat and the sound power circuit upon which the whole island command was dependent for air raid warnings. His skillful workmanship and fearless devotion to duty contributed materially to the successful operations of our forces against the enemy during a critical period when the island was under heavy siege. Corporal Vaughan's gallant

Soldier's Medal

Navy and Marine Corps Medal

conduct was in keeping with the highest traditions of the United States Naval Service."

In a very different field is the achievement of Lieutenant Commander George M. Ankers, U. S. Naval Reserve, Office of Salvage, Bureau of Ships, a lineman in the Pacific Telephone and Telegraph Company, who has become one of the Navy's outstanding salvage experts. After directing the raising of the first sunken battleship to be floated at Pearl Harbor, he landed in North Africa with a commando group and helped to clear the harbor of Oran of obstructions placed by the enemy there. His Legion of Merit was awarded—and special commendation from General Eisenhower was given —for his work as

"Salvage Officer at Bizerte, Tunisia, during the month of May, 1943. Charged with the difficult task of opening the channel to Lake Bizerte which the retreating enemy had blocked with wrecked ships, Lieutenant Commander Ankers immediately initiated plans for blasting an opening through the obstructions. Although subjected to persistent enemy air raids during the operations, he persevered in the face of constant danger and achieved success to the extent that in record time the Port of Bizerte was almost fully utilized. Lieutenant Commander Ankers' extraordinary ability and courage in the timely completion of an important task contributed immeasurably to the uninterrupted supply of allied armies for future operations in Sicily and Italy."

In one of the first of those operations, Major Rand S. Bailey of the Corps of Engineers, an engineer in the A. T. & T. Company's Operation and Engineering Department, performed outstanding services leading to a Legion of Merit award.

"During the planning, training, and operational phases of the Seventh Army landing operations on the southern coast of Sicily, Major Bailey was responsible for signal communications of the 1st Engineer Special Brigade and attached units. By the application of highly superior technical knowledge, by masterful control and coördination of the various signal teams in the Brigade communications net, and by extraordinary attention to duty, Major Bailey maintained highly superior radio, telephone, and courier communications with tactical Brigade and attached Units, and with cooperating naval units. He exercised outstanding initiative in discovering and em-

ploying serviceable captured enemy signal equipment. His untiring devotion to duty and his superior management and coördination of Brigade communications have been an inspiration to this command."

Bailey, who has more than thirty-five years' service with the New England Telephone and Telegraph Company, Bell Telephone Laboratories, and the American company, recently has been made a Lieutenant Colonel and has been awarded the Bronze Star Medal for his outstanding work in establishing communications for an Engineer Corps unit in Normandy on D–Day.

As the rapid-fire Sicilian campaign developed, two other Bell System men won the Legion of Merit through outstanding communications work. One of these awards, based on accomplishments both in North Africa and Sicily from November 8, 1942, to August 25, 1943, was given to Master Sergeant Orman H. McConville of a Light Construction Signal Aviation Battalion, a groundman from the New York Telephone Co.

"By his unswerving devotion to duty, cheerful coöperation, good judgment and initiative in the construction and maintenance of lines of communication, he has increased the efficiency of the battalion. During the North African and Sicilian campaigns he played a major part in the repair and maintenance of lines of communication by working day and night without sleep, many times without food, and under artillery fire, mortar fire, and enemy strafing. Sergeant McConville has rendered many valuable suggestions to his superiors pertaining to line construction and maintenance and by his skill and ingenuity many problems have been solved, enabling the battalion to function more rapidly and efficiently."

The award to the other man, Lieutenant Walter G. James of the Signal Corps, a lineman from the Pacific company, was based on his work in Sicily alone between July 12 and August 18, 1943.

"Lieutenant James was charged with the seemingly impossible task of installing and maintaining wire communications between a corps headquarters and rapidly advancing divisions during the Sicilian campaign. With dogged determination and outstanding initiative he led his men through unswept mine areas, often in the face of hostile artillery fire, and on several occasions in advance of the leading infantry elements. His lines were frequently destroyed by enemy action, but his conduct under adverse conditions, his leadership and high degree of technical skill inspired the men under his command to perform far beyond their normal capabilities, with the result that the vital mission was successfully accomplished."

Bronze Star Medal

Air Medal

One of the latest Legion of Merit awards reported has been that won by William R. Silvey, of the New York company's engineering department, recently promoted from Lieutenant Colonel to Colonel in the Army's General Staff Corps. Col.

Silvey is a veteran of World War I and was awarded the Silver Star for "bravery of the highest order" in that conflict. His present award is for outstanding services from October 20, 1943, to May 31, 1944, in connection with the advance planning of invasion operations,

"performed so tirelessly and efficiently that necessary information was in the hands of proper units well in advance of schedule."

THE SILVER STAR for gallantry in action has been won by thirty-one employees of System companies in the Army and by three in the Navy. One of these men, First Lieutenant Carl E. Anderson, an engineer from the Southern New England Telephone Company, also was awarded a Croix de Guerre with Gold Star by the French Government for the same achievement early in the Tunisian Campaign. A field artillery officer, responsible for his battery's observation posts, he helped to provide the advancing infantry elements with the best artillery support. In the language of the French citation,

"an officer of courage and coolness, worthy of praise. In the course of the Ousseltia engagement from 25 to 28, January 1943, he chose to accompany up to the enemy lines an infantry patrol. In spite of the heavy automatic enemy fire he succeeded in obtaining valuable information."

A few weeks later, during the critical retreat near Kasserine Pass before Marshal Rommel's furious counter-attack, the Silver Star was won by Private (now Technical Sergeant) Benton Lynch, of the Signal Corps, a cable splicer's helper from the Indiana Bell Telephone Company.

"On February 18, 1943, he was subject to hostile artillery fire, hostile aircraft, and approaching enemy tanks. Private Lynch was with a crew of six men that remained forward of our own front-line units in order to destroy existing pole line and wire facilities to prevent the use of the wire communication installations by the enemy. He executed his mission with complete disregard for his own personal safety although he was fully aware of the approaching enemy tank attack. The courage, heroism, and the unceasing devotion to duty displayed reflects great credit upon himself and the armed forces of the United States."

Silver Star awards to two other Bell System men for achievements in the same campaign are notable illustrations of the responsibility of the infantry for communications in combat areas. Members of the first infantry division, these two men, Russell K. Heller of the Ohio Bell Telephone Company's plant department, and Charles W. Hoertel, Western Electric installation department, were decorated for successfully repairing severed communications lines in exposed positions while subject to intense enemy fire.

Uninjured in that engagement, Hoertel was wounded at Mateur, captured by the Germans, bombed day and night by allied air forces while on a prison ship, rescued when Tunisia fell, and wounded again in Sicily. He is now recovered, and is a sergeant instructor in a Signal Corps school in an inactive area in Italy.

The Salerno beachhead in Italy will long be remembered for the powerful and desperate German resistance there. Another Bell System infantryman and winner of the Silver Star, Lieutenant Colonel Edward N. Harris, Jr., Long Lines testboardman from Texas,

"division liaison officer with an infantry

battalion, landed in the assault wave at Salerno Sept. 9, 1943, in the face of withering artillery, machine gun and mortar fire from organized and fortified enemy positions. Throughout the intense battle and despite repeated tank attacks and severe enemy fire, Colonel Harris moved among the most forward troops assisting in the attack. On one occasion, while well in advance of the attacking riflemen, he killed an enemy soldier with pistol fire. His calm leadership and cool determination inspired the attackers to increase their efforts to continue the battle to its ultimate success. His gallant action reflects great credit upon himself and the Armed Forces of the United States."

Meanwhile, far to the East, our forces were working their way toward Japan through the island outposts of the South Pacific. On July 20, 1943, at Bairoko Harbor, New Georgia, in the Solomons, Private First Class Elzie J. Hancock of the First Marine Raider Regiment, a cable repairman from the Southern Bell, in the face of intense fire, three times guided his company into position for assaults against a Japanese machine gun emplacement. When his entire battalion was threatened by devastating flanking fire, Hancock exposed himself with no concern for his own safety, to keep the right and left flanks of his company in contact with each other. Finally, leading a charge which silenced the enemy guns, he was killed. For his gallant action, Hancock was awarded the Silver Star posthumously.

A few months later, as preparations for the capture of another island were under way, Lieutenant James P. Lowry, U. S. Naval Reserve, staff engineer from the Bell Telephone Company of Pennsylvania, earned a Silver Star

"for conspicuous gallantry and intrepidity as member of a reconnaissance patrol to a Japanese-held island in the Pacific area during the latter part of December 1943. With no knowledge of enemy strength or the attitude of natives to the Allied Nations, and with limited means of escape, Lieutenant (then Lieutenant, junior grade) Lowry unhesitatingly went ashore in the face of certain danger and, within an exceedingly brief space of time, had secured information concerning the strength of

PFC. ELZIE J. HANCOCK
Silver Star (*posthumous*)
Killed in action

Japanese forces and their equipment and had determined the most suitable beach for future landing as well as favorable sites for bomber and fighter strips. Discovered by the enemy and in danger of being captured by a hostile party possessing superior arms, Lieutenant Lowry fought gallantly, assisting in ambushing and killing three Japanese, wounding one and putting the remainder to flight before struggling back through heavy surf to the rendezvous with a friendly craft. His outstanding skill,

heroism and resourcefulness in the successful execution of a vital mission were in keeping with the highest traditions of the United States Naval service."

A very recent report from Normandy tells of the Silver Star won by First Lieutenant Robert Hunter, Cavalry, U. S. Army, a lineman from the Pennsylvania company, who has

CAPT. JAMES F. DEVINNEY

Distinguished Flying Cross with two Oak Leaf Clusters, Air Medal with four Oak Leaf Clusters

A prisoner in Germany since late 1943

also been awarded the Bronze Star Medal.

"On July 12, 1944, the tank platoon commanded by First Lieutenant Hunter came under very heavy artillery and mortar fire, resulting in the death of one tank commander and the wounding of several men. Although he was wounded, First Lieutenant Hunter dismounted and, completely ignoring the danger involved, reorganized and led his platoon in a sustained attack, together with certain infantry elements. Only after the tanks had been withdrawn did he submit to medical treatment. The extraordinary heroism and devotion to duty displayed by First Lieutenant Hunter reflect great credit upon himself and the military service."

AWARDS of the Distinguished Flying Cross for heroism or extraordinary achievement in aerial flight have been reported for 101 Bell System men in the Army and for two in the Navy. One of these men, Captain James F. DeVinney of the Army Air Corps, an installer from the New Jersey Bell Telephone Company, has earned this award three times and is also the holder of the Air Medal with four Oak Leaf Clusters. That medal was first given for bombing missions over Europe early in 1943, when DeVinney became a First Lieutenant. On April tenth of that year, he was wounded but returned to duty within a month and, following another promotion, won his first D.F.C. a few days later for outstanding achievement while serving as group bombardier during a raid on

"a highly important military objective. Displaying great courage and skill under most hazardous conditions, Captain DeVinney, knowing that the bombing effort of the entire group depended on his accuracy, released his bombs directly on the target."

Within two months, an Oak Leaf Cluster to the D.F.C. was awarded for a raid over Sicily and three weeks later, on August first, the second Cluster was won in the long and hazardous raid on the Ploesti oil field. Given the choice of an immediate furlough or of further promotion on completion of two more flights, he undertook the flights, was shot down on the first one and reported missing

on August sixteenth, and a prisoner in Germany in December.

As pilot of five different British Spitfire fighters on 110 missions over Tunisia, Pantelleria, Sicily and Italy, Captain Donald J. Keith of the Northwestern Bell Telephone Company's accounting department has been awarded the D.F.C. in addition to the Air Medal with no less than eleven Oak Leaf Clusters. As the D.F.C. citation states,

"Throughout the North African and Sicilian campaigns, Lieutenant Keith has displayed outstanding courage and devotion to duty. On 10 June, 1943, while flying on a twelve-aircraft mission over Pantelleria, his squadron was attacked by more than twenty enemy fighters. When his wingman was forced out of position by six Macchi 202's, which attacked him from the rear, Lieutenant Keith unhesitatingly, and without protection himself, climbed toward the six enemy aircraft and, with a difficult head-on shot, destroyed the leader. Exploiting the advantage of surprise, he dispersed the five remaining Macchi's and saved his comrades from imminent destruction. On many combat missions his aggressiveness and consistent military proficiency have reflected great credit upon himself and the Armed Forces of the United States."

Missing in action since August, 1943, Lieutenant Lloyd O. Hendrix of the Southwestern Bell Telephone Company's plant department had won the Air Medal with eight Oak Leaf Clusters and the Distinguished Flying Cross

"for extraordinary achievement . . . as pilot of a P–38 type aircraft. On 18 July 1943, while escorting an air-sea rescue plane off the west coast of Italy, Lieutenant Hendrix sighted a formation of fifteen JU 52's flying at zero altitude toward Sardinia. After calling out their position, Lieutenant Hendrix attacked the enemy aircraft from the rear. Displaying exceptional flying skill and highly accurate marksmanship, he destroyed four of the transports in less than five minutes, and his comrades shot down the remaining eleven. Lieutenant Hendrix's cool efficiency in combat has reflected great credit upon himself and the Armed Forces of the United States."

No report has been received of the specific reason for the D.F.C. award

LIEUT. LLOYD O. HENDRIX
Distinguished Flying Cross, Air Medal with eight Oak Leaf Clusters
Missing in action since August 1943

to Major Emmet J. Thiesen, also holder of the Air Medal and several Oak Leaf Clusters, and a lineman from the Michigan Bell Telephone Company, but his skill as a pilot and the toughness of the conditions under which he flies are demonstrated by the fact that he is the personal pilot for Lieutenant General Joseph Stillwell in the remote and mysterious Burma-China area.

German submarine nests in the Atlantic ports of southern France have made the Bay of Biscay an essential area for long-range, hazardous Navy bomber patrols despite constant danger of attack from enemy fighter groups. Near this "Junkers' junction," two Bell System Navy lieutenants earned their D.F.C.'s in September, 1943. One of these men was Lieutenant (j.g.) Robert L. Bedell

CAPT. B. DONALD HANKS
Air Medal with six Oak Leaf Clusters
Missing in action since April 1944

of the commercial department of the Chesapeake and Potomac Telephone Company of West Virginia, who

"while his plane was under savage attack by eight twin-engine hostile fighters . . . rendered invaluable aid to his patrol commander in evasive tactics which enabled the gunners to inflict considerable damage on opposing aircraft. Although the big flying boat was set afire during the course of the engagement, her starboard engine knocked out and rudder shot away, he helped bring her down in a precarious crash landing at sea. Swimming clear of the burning plane, he assisted two wounded crew members aboard a rubber life raft which was leaking badly from gunfire, and by means of his own lung power managed to keep them safely afloat. His gallant spirit of self-sacrifice, maintained with disregard of personal safety, was in keeping with the highest traditions of the U. S. Naval Service."

Seven other men went down with the plane, all of them probably killed by gunfire before the landing. Bedell and his two companions, both of whom were wounded, were picked up by a rescue launch eighteen hours later.

In the other action, the assistance of Lieut. (j.g.) Paul B. Kinney, a traffic department man with the Ohio company, to his commander on a patrol bomber enabled its gunners to shoot down one and cripple three more of the six twin-engined attacking fighters.

"Although his own plane was set afire, her flying instruments rendered inoperative and her four engines badly damaged, he nevertheless carried on, despite painful wounds, until the big flying boat had successfully eluded the remainder of the enemy and landed safely at sea. His superb airmanship and courageous devotion to duty were in keeping with the highest traditions of the United States Naval Service."

In this instance, too, the plane quickly sank but the nine men aboard, despite injuries and high seas, covered seventy miles by paddling and sailing a rubber life raft and reached shore two days later. Six months later, Kinney won a Gold Star in lieu of a second D.F.C. for his skillful assistance to his commander in an action which probably sank an enemy submarine.

FOUR Bell System men are known to have won the Soldiers Medal and three the corresponding Navy and Marine Corps Medal. Although award of these medals does not involve actual conflict with the enemy, they have been given for actions requiring a high degree of heroism and skill. Typical of such action was that of Donald C. Bradley, Motor Machinist's Mate First Class, a lineman from the Illinois Bell Telephone Company, who won the Navy and Marine Corps Medal

"for extremely heroic conduct as a crew member of the U.S.S. LST 379 during the amphibious attack on the Island of Sicily, July, 1943. When the forward falls carried away as the assault boat descended to the water and the crew and Army personnel were thrown into the treacherous sea, Bradley unhesitatingly dived over the side of his ship and went to the assistance of the soldiers struggling under the weight of their equipment. Although handicapped in his gallant action by darkness and tremendous swells, he employed a life raft so skillfully that he was able to bring a number of the men to cargo nets, lines, and ladders on the vessel's side. Through his cool courage in a dangerous situation, he contributed to the expeditious rescue of the Army personnel and thereby enabled them to continue an important mission."

THE BRONZE STAR MEDAL, the newest decoration of the United States Armed Services, was established in February, 1944, for heroism or meritorious achievement not recognized by a higher award and not involving aerial flight. Of the thirty Bell System men in the Army and two in the Navy reported as recipients of this award, a substantial number have won it for communications work. Typical of this group is First Lieutenant Arthur W. Stillwagon of the Signal Corps, from the Michigan company's plant department, who commanded a construction platoon during the major part of the campaign in Sicily. Landing with one of the early groups, he and his men at first were subject continuously to strafing from enemy aircraft, and later, in order to keep pace with the advance, worked under artillery fire and through uncleared mine fields.

LIEUT. (J.G.) JOSEPH D. MCLAUGHLIN
Purple Heart (posthumous)
Killed in action

"The resourcefulness, untiring devotion to duty, and inspiring leadership continually exhibited by Lieutenant Stillwagon was outstanding throughout the campaign."

THE AIR MEDAL, given for meritorious achievement in aerial flight, has been won by 248 Bell System men in the Army and four in the Navy, and 588 Oak Leaf Clusters for repeated achievements have been awarded to

these individuals. Winner of six such clusters to his Air Medal, Captain B. Donald Hanks, a repeaterman from the Mountain States Telephone and Telegraph Company, "exhibited great courage and untiring energy" during sustained combat missions over enemy territory in the South Pacific, in many of which he acted as flight leader. A fighter pilot in the area from September, 1943, until April, 1944, Hanks has been missing in action since that time.

THE PURPLE HEART, established by General George Washington in 1782 as the Badge of Military Merit, this country's first military decoration, was revived in 1932 on the 200th anniversary of his birth and now is awarded for wounds received in action. Reports of its award are clearly incomplete, but, in addition to the many wounded, there have been 171 Bell System men killed in action in defense of their country to whom this award has been made posthumously. Among them is Lieutenant (j.g.) Joseph D. McLaughlin, an equipment installer from the New England company, who as commander of a P.T. Boat in the South Pacific for several months gallantly carried forward the seafaring tradition of that region. Participating in at least twenty-four engagements with Japanese destroyers and barges, he helped to sink several of the barges during their island-to-island retreats in the Solomons.

"As new PT bases were established to cut down the operating range, he and his crew moved to stay right on the heels of the Japs attempting sea-borne evacuations."

Finally, in an engagement on November 14, 1943, he was instantly killed; and his men, on a nearby picturesque island, set up a sign bearing the words, "McLaughlin's Grove" in memory of a gallant comrade and leader.

Purple Heart

AS WE acknowledge the courage, skill, and self-sacrifice of these men from the Bell System companies in the United States, it is fitting that we pay tribute, too, to those whose longer fight we joined, from the Bell Telephone Company of Canada, our near neighbors in arms and our associates in time of peace or war. Reports of decorations to twenty-three of its employees on military leave have been received. One of these men is Commander A. R. E. Coleman of the Royal Canadian Navy, who was Montreal buildings superintendent when called to service on September 10, 1939. Commander Coleman, who served on British submarines and destroyers in the first World War and later as first officer on a passenger liner, was made commanding officer of a Canadian cor-

vette assigned to convoy duty during the Battle of the North Atlantic. In the fall of 1942, his ship rescued fifty-four men from a torpedoed merchantman, in spite of heavy seas and continued threat of submarine attack. Early in 1943 his corvette, the *Ville de Quebec,* destroyed a German submarine in the Western Mediterranean. Brought to the surface by depth charges, the submarine was first attacked by every gun of the circling corvette and then rammed just forward of the conning tower, with such force that a gun was hurled overboard. The submarine immediately sank. For this action, Commander Coleman received the Distinguished Service Order and was praised in General Eisenhower's communiqué. He is now in command of the principal Canadian Naval Base on the Pacific Coast.

COMDR. A. R. E. COLEMAN, R.C.N.
Distinguished Service Order (Canada)
On active duty

The resourcefulness and courage of an installer from northern Ontario are described by the Canadian Company as follows:

"An enemy fighter plane attacked a giant R. A. F. Lancaster over the Alps. The navigator was killed and the pilot so badly wounded that he was unconscious. Flight Sergeant Allan W. J. Larden, bomb aimer, who had never flown a plane for more than a few minutes before, lifted the pilot from his seat and took over the controls. The enemy fighter was still at work and the big bomber had three damaged engines and some thirty-six bullet holes before Larden brought it down from 15,000 to 3,000 feet and headed for North Africa, five hours' journey away. He tried to jettison the bombs, but the release mechanism had been hit and would not work. Flying low over the Mediterranean he managed to make a perfect belly-landing near a town in North Africa. His good judgment and able handling of the plane is receiving the highest commendation and he has been awarded the Conspicuous Gallantry Medal, the highest award next to the Victoria Cross which can be won by a non-commissioned officer."

THIS is the record which, inadequate, incomplete as it is, shines forth. We pay homage to these Bell System workers as men whose deeds, at the cost or risk of their lives, are undying. For them, for the thousands of other telephone men and women in the armed services, and for the millions of their comrades-in-arms, we at home cannot fail to give every effort until their work is done and their purpose won.

Modern Electronics, Which May Be Said to Have Begun When H. D. Arnold Produced the First High-vacuum Tube, Is a Big Factor in Electrical Communication

The Rôle of Electronics in Telephone Service

Austin Bailey

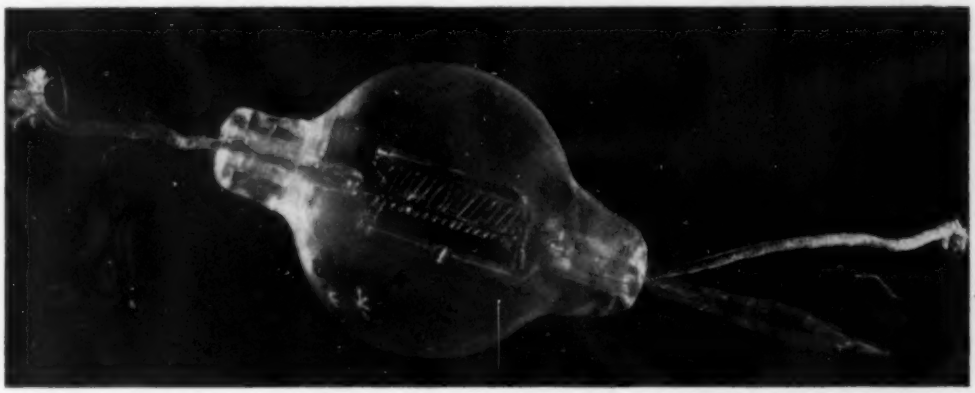
THE WORD "ELECTRONICS" brings to the mind of the general public today an association of magic, much as did the word "radio" during and after World War I. There is speculation about secret war weapons utilizing the science of electronics; popularized articles appear about its miracles; it makes headlines in advertisements and the press. It is one of the important catch words of the day.

What, basically, is electronics, then? Is it some spectacularly sudden achievement of science, a case of "something new has been added" to the realm of human knowledge?

Scarcely so! Spectacular it may be in some of its recent applications, particularly in warfare; and in this inventive and ingenious age some of its adaptations to peaceful use in the future may be even more significant. But for some 30 years people have been familiar with and have benefited in various ways by the practical applications of electronics on the part of those who work in the fields of electricity, chemistry, and physics —even though to the vast majority of people the very word until recently may have been unfamiliar.

Specifically, for more than a quarter of a century electronics has been helping the telephone to extend its reach, to carry conversations more clearly, to perform many of its operations better or faster or more economically. How electronics serves the telephone industry, and thus the telephone user, quite naturally requires some explaining—which can be deferred momentarily in favor of another and fundamental explanation: why and how electronics has been serving thus and for so long. It is because the late Dr. Harold D. Arnold of the Bell Telephone Laboratories, in his search for some suit-

able means for amplifying the weak electrical currents of communication systems without otherwise altering their characteristics, early recognized the importance of employing a high vacuum in which to control free electrons. It was on November 1, 1912, that he expressed the opinion that the operation of a certain device, the audion of Dr. Lee de Forest, would be improved by employing the highest obtainable vacuum; and that date, perhaps more than any other, marks the beginning of modern electronics.



AN HISTORIC MILESTONE along the road of electrical communication: the late Dr. Arnold's first high-vacuum tube

IN TELEPHONE PARLANCE, the device employed to amplify weak currents on telephone lines is known as a "repeater." Its purpose is merely to make a very small amount of current control, or impress its characteristics on, a current of much greater strength. In this way, the telephone current coming into the repeater, weakened from its journey over the wires, is started on its way again with renewed strength. An analogy which illustrates this purpose lies in the fact that a child, by exerting a small amount of effort, may turn a valve of a steam or hydraulic turbine, and can thus control the immense turning power of the machine.

So successful were the tests of Dr. Arnold's first high-vacuum-tube repeater that by 1915 repeaters of this type were used on the circuits employed for the first transcontinental telephone service. In the same year the same type high vacuum amplifier tubes were likewise employed for the first transmission of speech by radio across the Atlantic and, three years later, for the first practical carrier telephone system. Electronics had been put to work. It was already much more than a laboratory equipment in the Bell System.

As is the case now, so in World War I, the knowledge, energy, skill and resources of the Bell System

were turned to the one important task of contributing an "all out" effort toward winning the war. All the development effort was turned to perfecting the then modern communication equipment for the armed forces—radio-telephone to airplanes, improved telephone systems for ground troops, fire control systems for ships, submarine detectors and other similar equipment. Electronic tubes played an important part in many of these devices. The manufacturing facilities of the Western Electric Company and of other manufacturers were taxed to the utmost to fulfill the requirements.

When the armistice came in 1918, development of electronic instrumentalities for use in the telephone company was again undertaken. In 1923 satisfactory one-way radio telephone transmission to England was demonstrated which led to the opening of the first public transoceanic radio service at the beginning of 1927. Commercial telephotograph service was inaugurated in 1924, and the following year nation-wide network broadcasting circuits were made available. Other events, such as intercity one-way television in 1927 and the 1930 two-way television demonstrations in New York City are mile-stones in the application of electronic techniques in the Bell System.

Electron, Proton, Neutron

TO ACQUIRE an understanding of—or at least a speaking acquaintance with—the principles of harnessing free electrons to do many kinds of work makes no excessive demand upon even the non-technical reader.

Let us make a start, then, with the atom: once considered the smallest indivisible piece of matter, it is still held to be the smallest piece of matter which retains definite chemical and physical properties. Scientists now recognize, however, that atoms themselves—and thus all matter—are composed of several kinds of basic particles put together in various combinations.

The simplest atom is that of the element *hydrogen* and it is made up of one electron and one proton. The electron is a negative elemental electrical charge and the proton is a positively charged elemental particle. The most complicated stable atom known is that of the element *uranium*, which contains 92 electrons, 92 protons, and the most common variety also contains 146 neutrons. Neutrons are uncharged elemental particles.

In all the elements, the electrons and protons are bound together by electrical forces; *but an external force which is sufficiently great can overcome the electrical forces which bind them together, and thus an electron becomes a "free electron"*—and as such available to joint the procession of its fellows and become part of an electric current. When that current flows in a wire, its useful applications are the subject-matter of electrical engineering—as the art was known up to a few years ago. Within the last generation, however, a new branch of the art has grown up, called *electronics* and dealing with the flow of electrons through a vacuum. For the purpose of this article, such an electron will be called a "free electron," although strictly speaking the term also includes electrons in wire-borne currents.

Any free electron is just like any

other electron, regardless of its past history. It has no genera nor species. It is, quite simply, an infinitesimal particle of negative electricity.

Electrons can be "freed" in a number of ways. The elaborate "atom smashers" in scientific laboratories do it, but so does the hot filament in an electric light bulb. Light falling on the surface of certain metals liberates electrons from those metals; certain so-called radio-active substances spontaneously liberate electrons in the process of disintegration; and still other methods have been found to produce free electrons.

Basic Principles

ONCE an electron has been "freed," it can be made to move through space at varying speeds and over controlled paths—provided nothing gets in its way to arrest its speed or divert it from its course. For example, Figure 1 pictures a filament, F, heated by the current flowing through it from the battery, A. The hot filament frees electrons and if a battery, B, is connected between the filament and a plate, P, inside an evacuated space in such a way that the plate will be positively charged with respect to the filament, then the "free electrons" will be attracted toward the plate and cross through the vacuum space to strike the plate. This is a flow of electric current and is shown by the current indicator, I. However, if the vacuum is not perfect there will be some residual gas molecules and atoms floating around in it. These are relatively very heavy in comparison with the free electron, and should such a molecule or atom happen to get in the line of flight of the electron a collision will occur, and the electron may bounce off it, combine with it, or discharge more electrons by overcoming the forces which bind them within the atom.

Today, thanks to Arnold, we know that the way to obviate such collisions is to reduce the possible sources of interference, and the liberation of free electrons *in high vacua* is fundamental to electronics—since under that condition the occurrence of collisions with residual gas atoms and molecules is reduced to the minimum.

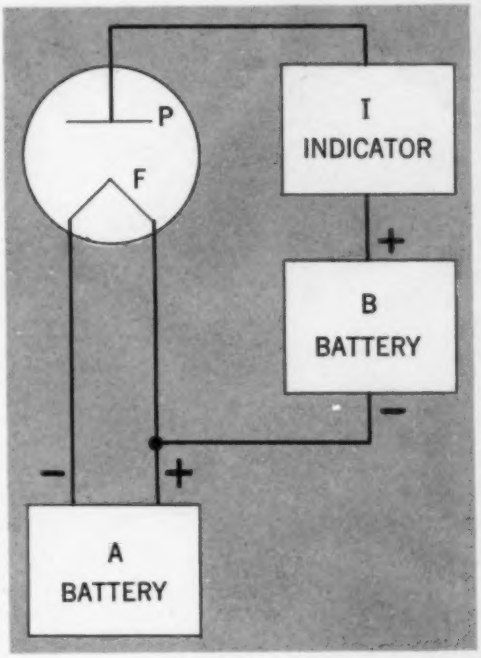


FIG. 1. A diagrammatic representation of the elementary principles of the vacuum tube

Handing On the Torch

MANY SCIENTISTS before and since Arnold have contributed to today's

knowledge of free electrons and how to produce, control, and utilize them.

In 1883 Thomas A. Edison was experimenting with the incandescent electric lamp. He had used in the process of manufacture of the carbon filament a third wire sealed through into the partially evacuated space. The filament was heated by direct current and he observed that if a meter was connected between this third wire and the positive end of the filament a current would flow through the meter while if connected to the negative end of the filament no current would flow. This phenomenon came to be known as the Edison Effect. It was, as is known today, the flow of free electrons through the vacuum as illustrated in Figure 1.

In 1904, John Ambrose Fleming with the knowledge of Edison's experiments employed the "free electrons" from a hot filament in a partially evacuated bulb to rectify high frequency electric currents. A rectifier is any device which will take an alternating current, one which flows first in one direction and then in the other repetitiously, and change it into a direct current which always flows in the same direction through the electrical circuit. Fleming was working as technical advisor to Marconi at the time and the "Fleming Valve," as his device was known, was the first practical application of the Edison Effect. The Fleming Valve was in no sense an amplifier, it was simply a hot filament to produce free electrons and a plate to collect the electrons which were freed. In place of the battery, B, in Figure 1 he applied the alternating current of radio signals. This, of course, caused a current to flow through the Fleming Valve while, during each alternation, the plate was positive with respect to the filament, but no current during the equal interval of time that the plate was negative with respect to the filament. In this way the radio signals were changed to direct current and the device was a detector of the radio signals.

Dr. de Forest in 1906 conceived the idea of interposing an insulated wire grid between the filament and the plate of the Fleming Valve. His invention was known as the audion. The grid acted to control the flow of electrons from the filament to the plate. Primarily its practical use was as a detector, which employs alternating current as a means to control direct current. In effect it is like a rectifier in that alternating current is put into the device and direct current is taken out of it. However, it is unlike a rectifier because the direct current is supplied by a source other than the alternating current itself which only controls the flow from this other source. Frequently the words "rectifier" and "detector" are used interchangeably when only the end result has significance. Radio frequencies were impressed between the grid and the filament of the audion while the connection to the plate was the same as shown in Figure 1. Because of the position of the grid this device was a more sensitive device than the Fleming Valve, the controlled current in the plate circuit, of course, being supplied by the battery, B, instead of directly by rectification of the weak radio signals.

These two contributions to practical electronics, the Fleming Valve and

the de Forest Audion, were of particular importance for their ultimate consequences upon telephony. Meanwhile, however, just as important contributions were being made in the field of scientific electronics. In the research laboratories over the world, discoveries and measurements of free electrons and their behavior came in an ever increasing number.

AT THE RIGHT in this picture are some of the 500 transmitting amplifier tubes used in projecting the human voice across the Atlantic Ocean for the first time, from Arlington, Va., in 1915

J. J. Thomson in 1897 succeeded in measuring the mass of the electron, small as it is, and likewise advanced the electron theory. This was followed by the brilliant work of Professor R. A. Millikan in 1910 in establishing the electrical charge of a single electron and thereby proving that every electron is just the same amount of electrical charge as every other electron. These and many other scientists have contributed much to clarify our knowledge about free electrons and their behavior.

Of course Arnold had knowledge of the electronic developments which had been accomplished when he made his epochal development. The telephone company engineers, with a vision of extending the range of communication, had been seeking for a good repeater. At least two other

types had been tried with varying degrees of success and when in 1913 the vacuum tube repeater became available it was at once apparent that this new electronic tool was destined to revolutionize the art of communication.

Figure 2 illustrates the most elementary form of this high vacuum tube repeater with a single grid, G, to control the flow of "free electrons" in the vacuum space. These electrons come from the hot filament, F, and travel through the space to the plate, P. Other necessary parts of the system to make a repeater of alternating currents, such as the currents set up in an electrical circuit by a telephone in use, are also indicated in the figure. These are the input circuit, I, where the low intensity alternating current signals are supplied, and the output circuit, O, where the amplified signals are taken from the repeater after passing through the transformer, T, which separates the alternating components of the current from the combined direct and alternating currents in the plate circuit. Besides this there are three current supply sources, A, B, and C, which are required for operation of the repeater. The A source heats the filament and "frees" electrons; the B source drives these electrons toward the plate; the C source is a

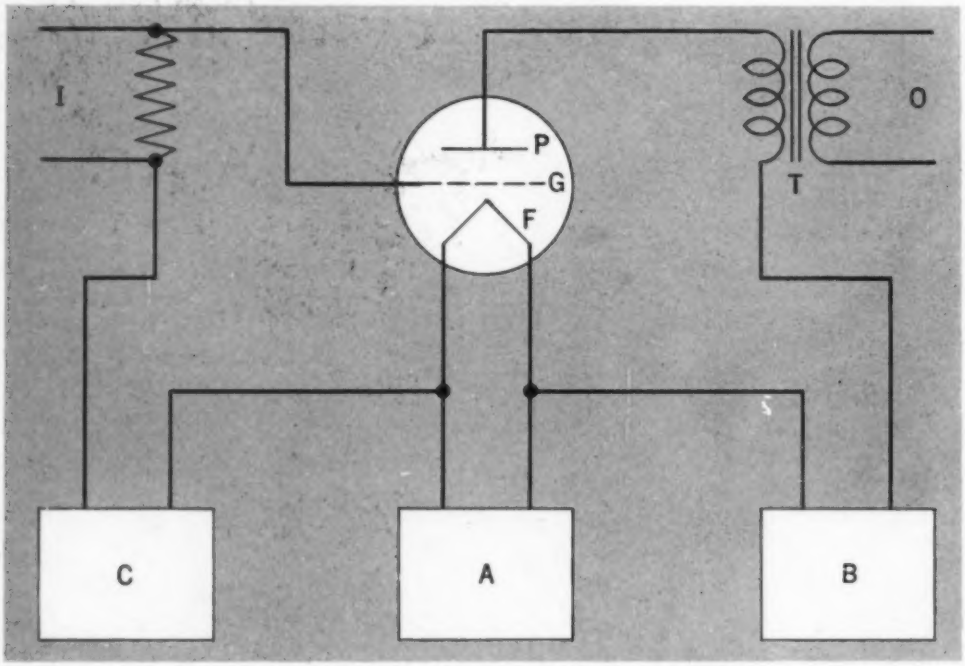
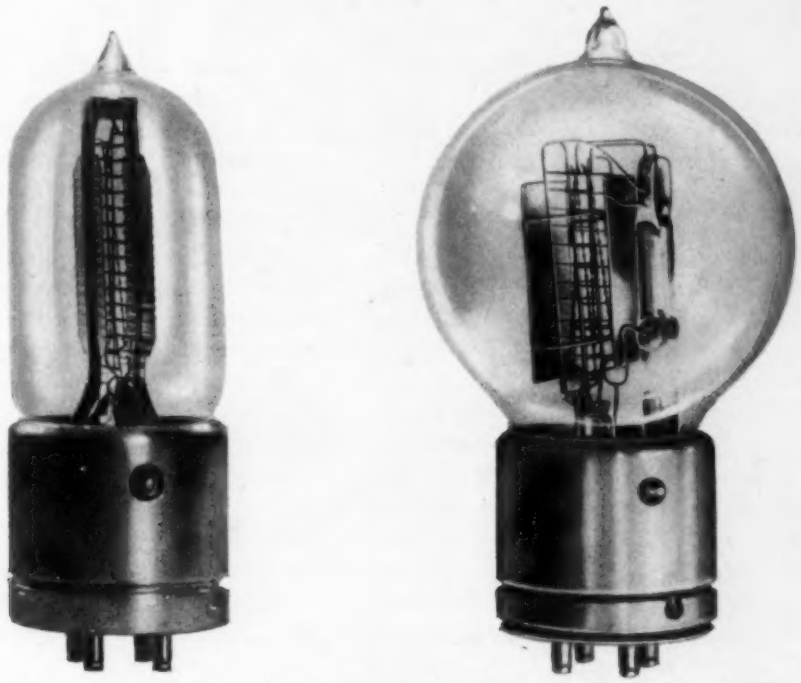


FIG. 2. A diagrammatic representation of the elementary principles of the telephone repeater. For explanation, see the adjoining columns

bias or balancing means which stabilizes this electron flow.

Tubes of Many Types

IN THE BELL SYSTEM there are now employed in connection with operating telephone services a total of around 290 different types of vacuum tubes. The equipment units in which these are employed are too numerous to mention. Telephone repeaters, carrier telephone systems of various types, ringing equipment on toll lines, radio telephone service to foreign countries, to ships, and across natural barriers, are only a few of the applications of the electronic art employing vacuum tubes. Applications of electronics in the telephone plant embrace a wide variety of uses. Not only are vacuum tubes used as amplifier elements, but they are used in oscillators to generate electric currents, in modulators and demodulators to mix alternating currents of different frequencies and produce new frequencies, and in many other ways.



SIGNAL CORPS receiving (left) and transmitting (right) tubes, made by the Western Electric Company, of the types used in the first World War

In size these tubes vary according to usage, from the diminutive ones used in hearing aids to the large water-cooled tubes required for the powerful radio amplifiers in the overseas radio telephone transmitters.

They vary in numerous other ways beside size, since special kinds of vacuum tubes are required to do many

different kinds of jobs. Tubes which have more than one grid between the source of electrons and the plate have valuable advantages in many cases. Numerous types of tubes are made in which the source of electrons is not the hot filament but a so-called cathode which is indirectly heated by the filament. This cathode has better properties in freeing electrons when hot than does a filament. Then in phototubes the electrons come from a metal plate, freed by the energy of the light which falls on it. Cold cathode tubes in which the free electrons are produced by breaking apart atoms of the gas remaining in the tube are sometimes used as rectifiers. Most recently Dr. A. M. Skillett of Bell Telephone Laboratories has developed a tube in which free electrons which are produced as "secondary electrons," splashed out of a metal plate by bombardment with a stream of electrons from another source, are employed to give a trigger action to the tube which makes it behave like a relay to open and close a circuit.

So diverse are the types of electronic tubes which have been devised by scientists and inventors that even to catalogue them would be a stupendous task. New and secret types have recently been developed for military purposes. After the war is won, many of these new types may be found to have value in telephone communication systems.

A Modern Aladdin's Lamp

WHILE WE ARE here concerned primarily with the science of electronics as it is applied as a daily commonplace to many phases of the operation of the telephone service, electronics touches the lives of most people in many other ways and performs other seeming miracles.

Miraculous is scarcely too strong a word, indeed, when one considers the kind of "material" with which scientists work. The mass of the electron is very small indeed, less than one eighteen hundredth of that of a single hydrogen atom. And its size? Well, scientists tell us that the size cannot be determined because of the nature of an electron. A pure guess as to size, based on assumptions which are known to be questionable, yields the result that somewhere near 25,000,000,000,000 touching one another in line would be about an inch long; and that such a line of electrons, extended all the way from the earth to the sun, would have a mass no greater than that of an ordinary pin. These comparisons are of interest largely because they help to fix in our minds how really small an electron is.

There are other strange things about an electron that are outside our ordinary concepts of physical things. It is possible, for example, to cause an electron to travel at a speed almost as great as the speed of light or radio waves, which, by the way, is 186,000 miles a second. When electrons travel at high velocity scientists tell us that the apparent mass of the electron is greater than when it is moving only at moderate speed. These are the strange particles which are a part of every thing around us and which, through their employment, have enabled man greatly to extend his ability to perceive the world about him.

With the aid of electronic devices, man not only can hear over a tele-

phone circuit sounds which have occurred at great distances from him but can hear sounds which are so weak that without amplifiers their presence would be impossible of observation. Sounds which exist outside the frequency range of the human ear can be transformed to frequencies capable of causing perception so man can "hear them" or at least can hear something bearing a known relation with the original sound.

Television, which even in its present infancy has enabled man to see things as they occur at distant places, is dependent almost entirely on the application of electronics. The x-ray, which is produced with electronic equipment, permits man to see through opaque objects, to discover flaws inside large metal objects, and otherwise to extend the sense of vision. The electron microscope, another electronic device, has enabled man to see objects which are 100,000 times smaller than could be seen before its invention. Electronic equipment has made possible distinguishing 2,000,000 shades of colors, a feat not possible for the human eye. With electronic devices continuous observation of phenomena can be maintained; they can count the number of parts coming from a production line or act as a silent watchman or door tender. And electronic devices are used to make some rapidly moving objects which the eye cannot follow either apparently to stand still or to move quite slowly, so that the eye can follow the motion.

Certain machines which formerly were controlled by the skill of the operator and his sense of touch are now controlled electronically to a precision far beyond that of the most skillful operator. Surface roughness and similar properties previously observed by touch are now measured electronically.

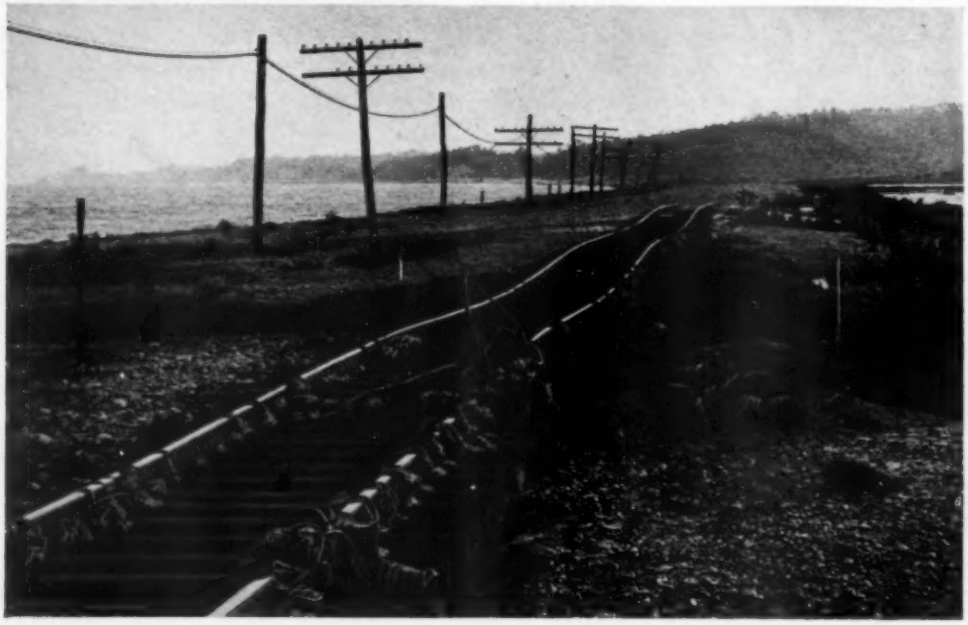
Taste and smell?—well, there may be electronic devices to extend these also.

CONTINUOUSLY there are about 1,500,000 vacuum tubes in operation in the Bell System. The annual requirement for replacements is about 250,000 and would be much greater except for the ingenuity of the electronic research engineer in designing tubes with long life as one primary objective. In such use electronics is no remote scientific mystery but a willing servant of a great industry, taught by the scientists at the Bell Laboratories—through study of what has gone before and their own developments—to perform in many ways which make service better, effect economies, and so benefit the telephone user every time he picks up the receiver to call the neighbor next door or some far distant corner of the earth.

WHEN, under the impetus of a hurricane, salt water attacks dry land, any resort community in the way must expect to suffer

SUCH VARIED craft as barge and sloop effectively block this highway

NO TRAIN ran here for several days, after the ocean had undermined roadbed and overflowed tracks. Telephone cable stands at left



For the Second Time the Bell System Demonstrates Its Great Recuperative Powers as a Tropical Storm Gets Off the Beam and Damages the North Atlantic Seaboard

A Hurricane Strikes Again

Judson S. Bradley

THE second tropical hurricane to strike the North Atlantic states in six years, chaperoned for a week by the U. S. Weather Bureau and reported on almost hourly during most of that period, lived up fully to its advance billings when it ravaged the coast from the Virginia Capes to Maine on Thursday and early Friday, September 14 and 15.

The warnings which preceded it undoubtedly saved many lives and some property, and they certainly helped preparations for the enormous task of restoration; but not by one iota could they abate the force and fury of the storm. And anyone who was inclined at first to look upon it merely as an exceptionally severe "equinoctial gale" soon changed his mind when he saw or learned of the devastation along the New Jersey shore, for instance, the cruel loss of trees in cities, villages, and forests, or the wreckage of houses and piers and small craft which littered Cape Cod almost from end to end in tangled confusion.

The hurricane of September, 1944, inevitably evokes comparisons with its predecessor of terrible and proud memories: the "New England hurricane" of September, 1938.* Broadly they have much in common. They have many differences of detail. To state that 414,500 telephones were put out of service by the 1944 blow, as against 597,000 in 1938, is to summarize both the likenesses and the differences; for while those totals are both very large, the former includes losses of eight Bell companies, while the latter is heavily weighted with figures from New England—which was much harder hit by the storm of 1938.

The figures for "stations out" in Virginia, Maryland, eastern Pennsylvania, and New Jersey last September testify to the more westerly course of the hurricane in those latitudes, while correspondingly fewer losses in upper New England indicate where it veered eastward and out to sea—instead of following again a course northward along the Connecticut River valley.

* See "The Bell System Meets Its Greatest Test," BELL TELEPHONE QUARTERLY, Oct., 1938.

HURRICANE OF SEPTEMBER 1944

AREA OF HEAVIEST DAMAGE

AREA OF LESSER DAMAGE

Long Island, eastern Connecticut, and Rhode Island were, for the second time in six years, victims of a fierce assault of nature whose like had not been experienced previously since 1815.

Other differences between 1938 and 1944 should also be noted here. Six days of rain in the former year had caused floods in many streams of New England and upper New York which did real damage even before that year's hurricane arrived. While the 1944 storm wind brought high and raging waves against shore communities and the entire coast, there was no single "tidal wave" like that which wreaked such great destruction in 1938. Nor did fire among weakened and collapsed structures bring the danger of conflagration which occurred in some communities half a dozen years ago.

NONE of this could be foreseen, of course, by those who were following tensely the reports and bulletins which preceded the eye of the storm northward: 9 A.M. on Thursday the 14th, over Cape Hatteras; 1 P.M. off Norfolk; 7 P.M. off Atlantic City; across the eastern tip of Long Island at 10 and into the Connecticut-Rhode Island shore by 11 P.M.; and southeast of Boston and out of Massachusetts to seaward by 2 A.M.

Such precautions as men may take against uncertainty they took before those hours struck. In some communities, which had learned their lessons the hard way in 1938, vehicles and pedestrians were forbidden the streets. In shore settlements, state or local police or perhaps the civilian defense organization ordered cottages evacuated—against the will, some-

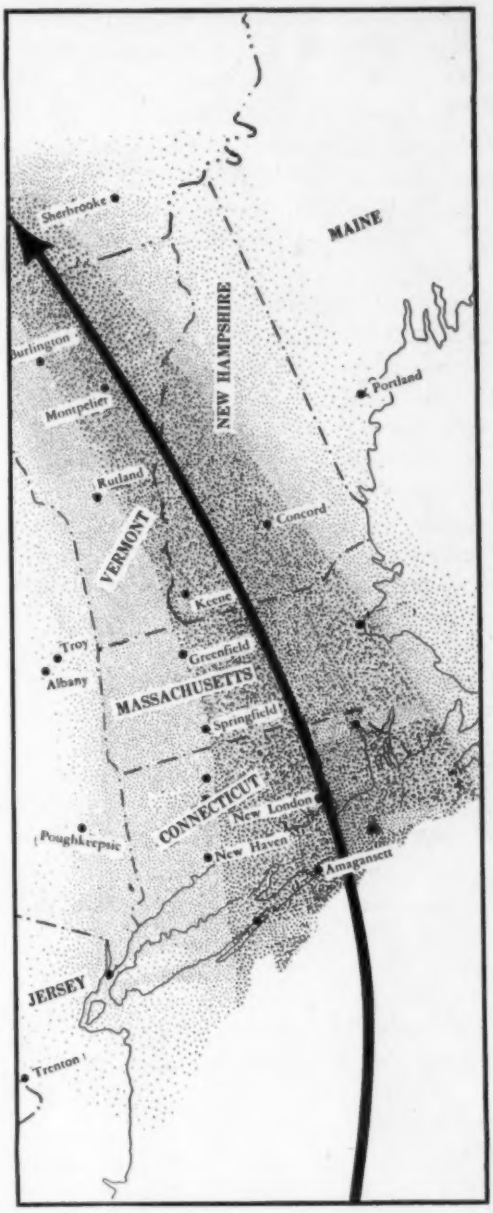
times, of residents who returned next morning to find placid waves lapping the sands where the day before a home had stood. In many a place in New Jersey, New York State, New England, school sessions were suspended, and anxious citizens made fast their awnings, took in the porch furniture, and looked up at the leaden sky or listened to the ominous warnings of the latest radio bulletin with foreboding.

Nor for telephone people was there any absolute prospectus of where or with what power the storm might strike. They knew from experience or report what a hurricane can do. They had had ample warning. There was but one course to pursue: expect the worst, make every sensible preparation, take every reasonable precaution—and stand by.

Braced and Set

DAYS OFF and vacations immediately impending were cancelled, so that full staffs might be on hand. That took place in practically every telephone unit in the threatened territory. So did the full charging of central office batteries, and the tuning up of standby power plants—or the obtaining of emergency charging apparatus. For without "juice," the voice of a telephone system soon wearies and gives out.

In one territory, scores of telephone trucks which had been put up on blocks, to conserve gasoline and tires, were made ready, before the storm's advent, for service on the road. In another area, all repair and construction trucks were brought in to central points and held there, for quick dispatch when and where the need became known. Again, other



HURRICANE OF SEPTEMBER 1938

AREA OF HEAVIEST DAMAGE

AREA OF LESSER DAMAGE

plant crews were sent home early with instructions to get some rest and be ready to report back to their local headquarters upon summons. Line personnel of the Long Lines Department was "alerted" from Key West to Boston.

The Long Lines Department also dispatched a portable radio telephone transmitting and receiving set from Denmark, S. C., to follow on the heels of the hurricane and bridge any gap in Long Lines wire circuits; but fortunately it was not put to use.

As word of the hurricane's approach became increasingly definite, state by state, items of plant supply were carefully checked, and loaded trucks from Western Electric distributing houses began to roll out to telephone company cable yards and stock rooms. So, in turn, trucks and trains ran from the merchandise departments of the Kearny and Hawthorne Works to replenish stocks at the distributing houses.

In the central offices, at test desks and power panels, other plant men kept vigil over their equipment—alert for first indications of the serious damage which was confidently expected.

As far as preparation was possible, plant forces were all braced and set.

The Calls Increase

MEANWHILE, the nearer the storm gyrated, the higher mounted local, toll, and Long Lines traffic. Augmented forces were at the switchboards, and of course dial calls clicked merrily through the apparatus. Near-record highs were established prior to and during the blow which were only to be exceeded by new records the following day.

Two occurrences are revealing. On Thursday, the day of the storm, 155,000 calls were made to the automatic weather reporter in New York City, and 135,000 to the similar service in Boston—both figures being higher than any previously reached. And in several communities along the Atlantic coast, local calling before and during the hurricane reached such a pitch that radio broadcasts were employed to ask people to telephone only for urgent reasons—lest the switchboards become too congested to put through true emergency calls if the need for them should arise. The immediate drop in the calling rate tells something, it may be, about the public's acceptance of the telephone's rôle in an actual emergency.

In each of the Bell System operating companies affected, one other unit, numerically small, stood by as the storm sped northward: the information and public relations department. The experience of 1938 had demonstrated that a public which is quickly and thoroughly informed about the steps being taken to restore service is a public which is patient and understanding and appreciative; and, along with the operating departments, those offices were manned at all hours and were able not only to keep newspapers and radio stations informed about the telephone situation but even upon occasion about the course and progress of the hurricane itself.

THERE is a sketchy word-picture, then, of conditions at any given locality upon the Atlantic coast within the territories of eight System companies, at the moment when a storm of horrendous but unknown power

impends. Observe, if you will, that only at the switchboards and in the dial equipment rooms is there great activity. Elsewhere is the poised calm of a coiled spring.

Then the wind and the rain begin, and quickly mount to fury: the wind in shrieking gusts that rise to 150 miles an hour and drive the torrents of rain in horizontal sheets. Along the shore the waves pound in with an inexorable might which alters, shifts, or demolishes most things which it encounters. Over the storm's wide swath, great trees are uprooted or snapped off.

Within two to four hours the storm passes, to be followed, in ironic contrast, by a calm sea and a bland and sunny day or starlit night.

But the trees, themselves victims, have wrought vast destruction to overhead wires and cables of every kind.

Three-way Damage

To telephone plant they caused damage in three ways last September. They crashed down upon cables, frequently rupturing them or bearing them to the ground. They knocked down "drop wires"—the connecting wires between the building and the main telephone line. They brought down live electric wires which "burned" telephone cables, melting the wires within or allowing moisture to penetrate or perhaps blowing fuses at one end of the line or the other. Of the 414,500 telephones knocked out of service, all but a relatively few were disabled directly or thus indirectly by trees which fell before the gale.

Comparison Between Hurricanes of 1944 and 1938

	Hurricane 1944	*Hurricane 1938*
Telephones Affected		
New England	132,000	400,000
Southern New England	60,000	106,000
New York		
Long Island	80,000	30,000
Bronx-Westchester	21,000	11,000
Upstate New York	2,000	15,000
New Jersey	92,000	35,000
Bell of Pennsylvania—Eastern	12,000	—
Chesapeake and Potomac—Md.	12,000	—
Chesapeake and Potomac—Va.	3,500	—
Total telephones affected	414,500	597,000
Employees borrowed from other areas or companies for storm restoration	950*	2,400
Vehicles borrowed	350*	620
Elapsed time to restore all telephones	12 days†	28 days†

* Excluding shifts of own men by New England and So. New Eng. companies.
† Temporary restoration in many cases.

EVEN relatively small trees sometimes produce a tangle of confusion as they go down

THIS is what the hurricane left of one church

TREE LIMBS, wire, and pole top and cross arms present a problem to the restoration forces

Yet surprisingly often a telephone line remained virtually intact while supporting a single big tree or even a row of trees which had bowed before the wind's violence.

The loss of such a great number of telephones is certainly an index of the storm's ferocity, but it is by no means the only consequence. Because electric light and power circuits are also vulnerable, nearly 400 telephone central offices were without "commercial" power for varying periods, but the emergency precautions mentioned earlier kept them all in service.

Forty-four communities were telephonically isolated for varying periods, and more than 1,000 toll circuits were affected; but the Long Lines Department's important circuits into and through the storm-smitten areas suffered little damage—thanks, no doubt, to such facts as that much of its plant along the eastern seaboard is underground, that a good deal of it was strengthened after 1938, and that gas pressure protected many of its main cables. Its New York traffic control bureau was a key point in making sure that toll circuits throughout the coastal area were working at their greatest possible efficiency, and a similar bureau of the New England company in Boston was correspondingly effective in its territory.

AS THE hurricane passed, many things began to happen, telephone-wise. But one thing just kept on happening more and more, and that was telephone calls—local, toll, and Long Lines. Random figures will illustrate the point: local traffic 25 to 35 percent above normal at Boston and 60 percent above normal at Providence during the three days after the storm; 172,000 toll board calls in New York City on the Friday after, a 40 percent increase above average; and a Long Lines count of 87,576 in New York on the same day —also a 40 per cent increase. In Atlantic City on the day of the hurricane a working force of 130 operators put in 318 hours of overtime: the equivalent of 45 more operators.

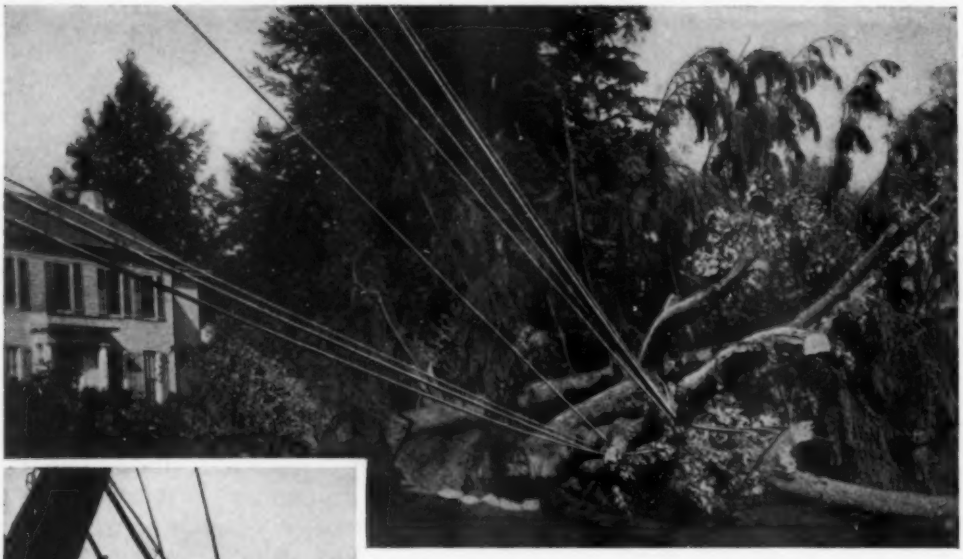
Many people were anxious about friends or relatives, some had to place calls about hurriedly changed plans, and to others the hurricane was a major event and thus a topic for conversation. Every central office from Norfolk to Bangor had a new traffic record of some sort—or so it seemed.

What, then, of the people who couldn't make calls because they had no telephone service—the 25,000 customers in the New England company's New Bedford district, the 80,000 on Long Island, the 3,500 in Virginia, and all the others in between?

Organization, Standardization, Teamwork

NOW IT IS that the coiled spring, static no longer, begins to unwind, to exert its dynamic strength. Bell System manpower, skilled, intelligent, directed, takes up the task for which it has been poised. The storm is over—the trucks roll!

They can roll, of course, because there are planning and organization and supplies and standardization, yes, and System-trained men—and System-trained girls back in the offices keeping track of things—to restore so much plant to provide service to so many people. But that is the combination that can do it.



No AERIAL telephone plant is designed to withstand so great a weight, yet service did not fail here

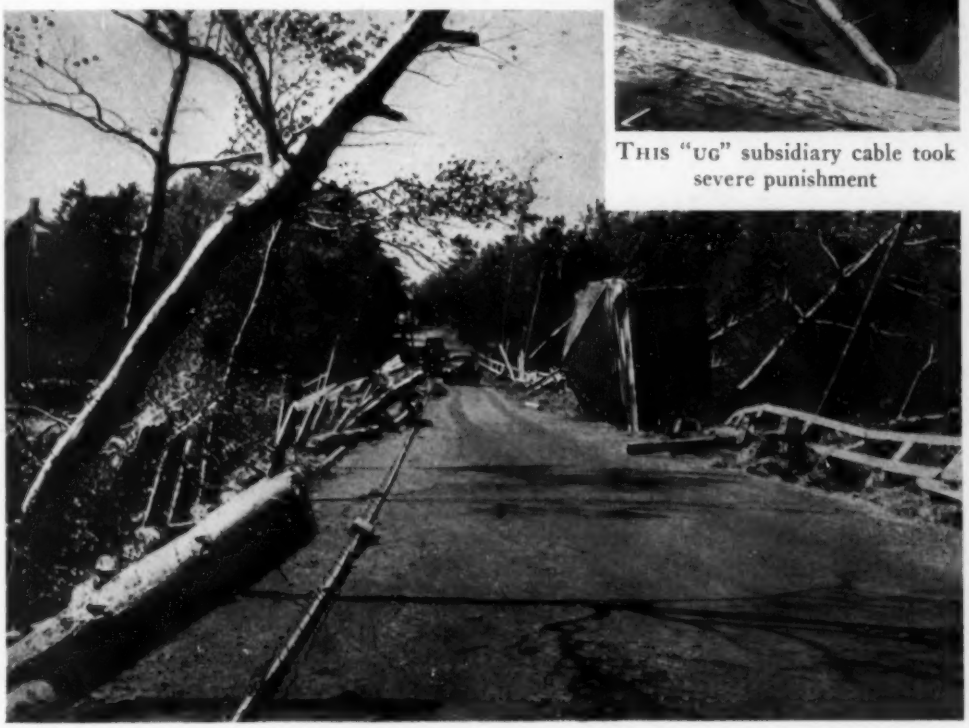
A "POWER BURN" was caused at the right-hand contact

WIRE SERVICES, as well as some one's home, suffered in this general smash-up

TELEPHONE CABLE and suspension strand could "take it" better, in this case, than could the trees

THIS "UG" subsidiary cable took severe punishment

THE telephone cable lying at the side of the road may still be carrying messages. Many others did so



From Bangor to Richmond, plant men swing into their stride: line and splicing crews, of course, installers and repairmen; but with them now are other helpers—engineers and mayhap commercial representatives, to gauge and report calamity's extent; central office men because they, too, can lend a hand; and a miscellany of recruits who once wore climbers or could wipe a splice and now pass up the office for a chance at the firing line again.

12,000 Men at Work

HERE IS a round and telling statistic to puff the proverbial pipe upon: during the period following the storm, about 12,000 employees were engaged in service restoration. These included nearly a thousand men, either shifted within their own territories by the companies affected or lent by other Bell companies as far west as Ohio to help with repairs in the badly damaged locations.

The New England company, with perhaps only a third as much damage in total as in 1938, found its greatest losses were in the vicinity of Buzzards Bay and on Cape Cod. As soon as a hasty survey showed what the situation was, that region—the New Bedford district—was organized on a divisional basis, with local areas becoming temporary districts in charge of plant superintendents, brought in to supervise the men from other districts who rolled in with their trucks and tools from as far away as Bangor to the east and Rutland to the westward. Many a cable waited for restoration until some huge tree could be removed, many a pole waited for a tangle of electric light wires to be straightened out before a telephone wire could be hooked up to it. And many a telephone will not be recovered nor service restored because both house and telephone are gone—the house's wreckage to join the ocean's flotsam, the instrument to rest on the ocean's floor.

To find food and housing for a couple of hundred extra men at shore resorts out-of-season was just one more complication, and, like others, it was solved. To local residents and late-staying summer visitors, who noted and commented favorably on the number of telephone trucks in evidence up and down the Cape, service was restored—often on a temporary basis—by the end of the week following the storm.

Storm damage in Connecticut, the territory of the Southern New England Telephone Company, was likewise less by perhaps half than in 1938 and, since it was fairly evenly distributed throughout that relatively small area, the company found that it had to do little shifting of its forces. As elsewhere up and down the coast, skilled repair forces worked long daylight hours, while others spent night shifts in testing, planning, and recording, to get service back within a week to the 60,000 silent telephones.

IN NEW YORK and New Jersey the opposite situation prevailed: those two companies, which, broadly speaking, had escaped with somewhat lesser damage in 1938, had now caught the full fury of 1944's hurricane, and the destruction this time was severe. In the New York company's territory there was again a heavy concentration of trouble on Long Island; the New Jersey company's report

showed ocean-flood damage along the shore and tree damage back from the coast line.

Here, it appeared, added help would be effective, would serve to get service back to more people more quickly.

Bell System companies beyond the storm's range had already been "alerted", so it was no surprise to the Ohio Bell, the Bell of Pennsylvania, and the Chesapeake and Potomac companies to be asked, once the New York-New Jersey situation was comprehended, to lend a hand—300 of them, in fact. The New York company had been able to move some 600 of its own men from other districts to the critical areas too, and some Long Lines crews were able to turn to on local service restoration. They started rolling on Friday, the day after the hurricane, and by the first of the following week some 950* "strangers"—line gangs and splicing crews and installer-repairmen with their own foremen and trucks and tools—were working from dawn to dark side by side with the local men and rapidly ceasing to be strangers.

With such help, the two companies' trouble reports grew less by daily leaps and bounds, and within a week the biggest jobs they have ever had to tackle were well nigh completed, all but exceptional instances of no-service were restored, and the visiting crews were on their way home again with a hearty "So long, fellows!" and "We'll do as much for you some time."

*These figures do not include men shifted by the New England and Southern New England companies within their own territories.

Facts and Figures

FOR THE affected area as a whole—perhaps half the length of the country's entire Atlantic coast line—71 percent of the total number of telephones "out" were back in service again within three days after the storm, 87 percent within six days,

Comparison of the More Important Materials Furnished by Western Electric Company

	Hurricane 1944	*Hurricane 1938*
Lead Covered Cable	864,786 Lin. Ft.	3,944,480 Lin. Ft.
Cable Terminals	3,726	21,735
Drop Wire	16,000,000 Lin. Ft.	56,613,000 Lin. Ft.
Poles	3,936	23,632
Crossarms	6,840	26,900
Copper Line Wire	48,300 Lbs.	1,117,500 Lbs.
Steel Line Wire	107,200 "	1,351,800 "
Strand (suspension)	955,000 Ft.	6,910,000 Ft.
Copper and Steel Sleeves	577,850	2,956,500
Hardware (Pole Line)	434,600 Lbs.	2,039,000 Lbs.
Solder and Lead Sleeving	44,674 "	628,200 "

CABLE SPLICING is a craft which shows to great advantage when one splice may restore many telephones to service

FROM DAWN to dusk the work of restoration progresses

HERE IS another instance of telephone plant which stood up—even though the tree did not

EMERGENCY repairs for government offices, municipal forces, hospitals, and others were made around the clock

"TWISTED PAIR" temporarily bridges a break through the woods

SKILLED MANPOWER, vehicles, supplies, and standardization have their parts in licking a situation like this

and 99 percent within 10. The "all clear" of emergency restoration sounded on the 12th day. The necessary tasks of permanent repair, in some instances the equivalent of new construction, will probably continue in many localities into 1945.

Such statistics as the 12-day figure for the restoration of 414,500 telephones to service last September need some interpretation if they are to be considered in relation to the 28 days required in 1938 to restore 597,000 telephones. The floods and blocked roads which hampered repair crews and slowed up supplies in 1938 were a negligible factor in 1944. Damage by falling trees was less this year—in the sense that where one cable break could and often did put a hundred or more telephones out of order, half a dozen breaks in one cable disabled no more telephones in 1938, but did require just that much longer to fix. Another element was the distribution of damage in the territories of eight Associated Companies this time, as compared with a heavy concentration then of trouble in New England.

The figures on page 193 for the quantities of supplies which Western Electric delivered in 1944 and 1938 sum up the comparison neatly—and demonstrate once again that "stations out of order" alone is not a complete index to the extent of a catastrophe.

The Service of Supply

BASIC TO restoration of telephone plant is a sufficient supply of equipment and materials, readily available for distribution where it may be needed. That is Western Electric's share in meeting any emergency, big or little: to see that they are on hand when and where they are needed. How well it succeeded in meeting the enormous demands imposed by last September's hurricane is told in part by the same statistics of supply.

They do not tell, of course, of such things as thousands of pounds of supplies carried downstairs by hand under the beams of flashlights when commercial light and power failed the Boston distributing house, nor of the night-and-day operation of the Brooklyn house for 10 consecutive days; neither do they give any picture of the indispensable function of Western's supplies service division at New York headquarters in coördinating the flow of supplies from many sources. Emergency routine is not new to Western people; and the Associated Companies, knowing that repairs are never held up for lack of materials, accept them gratefully and build them swiftly into plant.

How and why this can be so may be demonstrated, for example, by the following incident: On September 18, an 11-car express train loaded with telephone cable, suspension strand, and pole-line hardware left Western Electric's Hawthorne Works in Chicago soon after the New England company's needs had been made known, picked up three more cars at Pittsburgh and one at Kearny, and rolled into the yard of the Boston distributing house just 22 hours after it left Chicago. The running time of the Twentieth Century and the Broadway Limited between Chicago and New York is only five hours less!

THERE IS literally no part of an operating telephone organization which is not affected in some way by so great an emergency as a hurricane. Take

WESTERN ELECTRIC Co. supplied more than 160 linear miles of telephone cable to repair damage

UNLOADING pole-line hardware

A "SWITCHER" backs the "22-hour Chicago-Boston flyer" into Western's Boston house

THESE BELL SYSTEM men, on from Ohio, are all ready to do familiar jobs in strange territory

TRUCKS AND MEN are about to start from Washington for New Jersey and New York

UPSTATE NEW YORK installer-repairmen arrive to give their fellow plant men a hand

as just one instance the credit adjustment which the company voluntarily makes on the bill of each customer whose service is out of order for more than a day or so. The Commercial Department calculates the amount of the credit due in each case, and advises the Accounting Department, in order that the credit for the period of interruption may appear on the customer's next bill.

This is simply standard Bell System practice, of course; but many customers are aware of the extent of hurricane damage to telephone plant and appreciative of the effort to restore service, and insist on paying the bill in full. One customer wrote after last September's storm, for example, that he had had service since 1906, that a hurricane is an act of God for which the telephone company is not responsible, and that he would not accept the credit deduction from his bill.

Ever inspiring is the sense of obligation which brings telephone women to their posts, when due for duty or as volunteers for extra assignment, in the face of gale and torrential rain and possible hazard. Nearly every central office had its numbers of girls who arrived buffeted and drenched. The number was so large at Long Lines switchboards in New York, for example, that matrons' uniforms were given to dozens of them to put on while their own clothes dried. Operators at many central offices were accommodated at nearby hotels on the night of the storm or were put up on lounges and cots in telephone company rest rooms.

Not so easily arranged were quarters for the out-of-town plant men. On Long Island, cots were set up in an armory, for instance, until a summer hotel could be re-opened and put into operation; and on Staten Island the Army provided sleeping quarters in barracks for a hundred men pending the securing of hotel accommodations for them in Manhattan. Both Army and Navy personnel proved cordially coöperative when asked to give an occasional "assist" to the process of getting service back quickly into running order.

Civil authorities also were helpful in many ways. Most obvious, perhaps, was their willingness to make gasoline quickly obtainable for necessary car and truck operations.

AND THE final word should be devoted to the telephone-using public, surely; the public which constitutes many a statistic in these pages but is, none the less, just the men and women whose patience, whose tolerance, whose understanding, whose cordial encouragement added up, it appeared, to confidence that the Bell System was able to and would accept its responsibility, meet the situation, and carry forward the heavy task of restoration to a prompt and successful conclusion. The Bell System has *earned* that confidence through many years of normal operation and of emergencies met and overcome. Its men and women demonstrated in those days of crisis last September, as in the less trying tasks of day-to-day service, that always they do what is in their power to do to deserve the public's confidence.

Frank Baldwin Jewett: An Appreciation

Robert W. King

ON SEPTEMBER 30, 1944, being sixty-five years of age, Dr. Frank B. Jewett retired as Vice President of the American Telephone and Telegraph Company and Chairman of the Board of the Bell Telephone Laboratories.

While a young instructor at Massachusetts Institute of Technology, he was attracted by the future of telephone engineering, and in 1904 he joined the research and engineering department of the American Telephone and Telegraph Company, then located in Boston. The loading coil had but recently been introduced, the American Company had purchased the Pupin patents, and the stage was set for energetic prosecution of the possibilities inherent in the new device. The longest open-wire circuit then ran from New York to Chicago and there was no toll cable except a little toll-entrance cable. In this atmosphere Dr. Jewett soon demonstrated his ability to guide and supervise difficult engineering developments and to keep their various phases in step. The tasks that were to come along were of such magnitude and complexity as to give full scope to his outstanding executive talent.

Building upon the loading coil, the New York-Denver line was successfully completed in 1910 and the Boston-Washington underground cable in 1913. These triumphs, however, represented the telephonic limits of loading combined with economic sizes of copper wire. They therefore emphasized the urgent need of a satisfactory repeater.

On the basis of the leadership which he had successfully demonstrated on earlier projects, Dr. Jewett was selected to guide this important quest, and was appointed Assistant Chief Engineer of the Western Electric Company, where he might closely supervise the special repeater studies. The venture was crowned with success, and within three years a practicable basis for transcontinental telephony was at hand in the now familiar vacuum tube which had its genesis in the Edison effect and the deForest audion.

It soon became evident that the vacuum tube had no peer among amplifying devices; in fact, long before completion of the transcontinental line, it was realized that a satisfactory repeater would be the *open sesame* to radio telephony, and the leadership of the scientific group which Dr. Jewett had assembled was again attested by their record-making triumph when, in 1915, they transmitted the voice by radio from Washington, D. C., to Paris and to Honolulu.

The Laboratories under Dr. Jewett now grew rapidly and other practical applications of research followed in quick succession. The vacuum tube, combined with the electric wave filter

invented by Dr. George A. Campbell, realized the old dream of multiplexing both telephone and telegraph channels, first on open-wire lines and then in cables. The Bell System's extensive toll cable project also began to take shape.

As Chief Engineer of the Western Electric Company, then as Vice President, and later as Vice President of the American Telephone and Telegraph Company and President of the then newly-incorporated Bell Telephone Laboratories, Dr. Jewett provided much of the inspiration, leadership, and drive which carried these and many other projects through to completion. Among such, mention must at least be made of developments in the field of dial equipment, in telegraph equipment, and in improved subscriber stations.

Dr. Jewett's foresight and courage were largely responsible for the development of the Bell Telephone Laboratories into the world's leading agency of applied science. Being at heart both a scientist and an engineer, he early appreciated the essential part that coöperative teamwork among considerable groups of technologists must play in the rapid and effective solution of problems as intricate as those frequently to be overcome in engineering. He always preached the philosophy of team-

FRANK BALDWIN JEWETT

work, and was meticulous in his care that credit for achievements went to the team.

In his capacity as leader of the research and development forces of the Bell System, Dr. Jewett's counsels have always played a considerable part in formulating and maintaining the policy of the maximum of economic life which underlies the design of our equipment and the engineering of our telephone plant. His scientific instinct has never been satisfied until he could envisage the best solution of a problem that would be possible in terms of the then available knowledge. After this, and step by step, he would consider such compromises as had to be made to reach a practical solution, but was always reluctant to yield more ground than absolutely necessary.

In propounding his philosophy of industrial research, Dr. Jewett has insisted that the basis of understanding coöperation between the various departments of a large laboratory is something which cannot be created quickly, but must develop slowly over the years with association and with tasks successfully accomplished. Continuity of employment in the technical staffs has therefore been a matter of great insistence with him and one for which he has fought valiantly on occasion.

The soundness of his philosophy has been brilliantly demonstrated by the war achievements of the Laboratories he so long directed. In such vitally important programs as in radar, in underwater warfare, and in fire control mechanisms, the Bell Telephone Laboratories have played an indispensable part; while the host of other projects to which they have contributed is too numerous to mention.

Since its creation by Executive Order in 1940, Dr. Jewett has been a member of the National Defense Research Committee, and has devoted a great deal of his time directly to the scientific problems of the war through that Committee. He has also served as President of the National Academy of Sciences since 1939. This is an assignment which one might say has been surcharged with war responsibilities, for by its charter the Academy undertakes upon request to advise the Federal Government in any matters of a scientific nature.

So, upon his retirement from the telephone organization, Dr. Jewett goes forth to spend his full time on war assignments. No one hopes more than he does that these will soon pass out of existence, but until they do his long telephone record attests that the job will receive the unstinted effort of a tireless body and a tireless mind.

The Frank B. Jewett Fellowships

ESTABLISHMENT of a trust fund by the A. T. & T. Company to finance post-doctorate fellowships in physical science in honor of Dr. Frank B. Jewett was announced on September 22.

Five fellowships will be awarded annually. Their purpose is to stimulate and assist research in the fundamental physical sciences, and particularly to provide the holders with opportunities for individual growth and development as creative scientists. The fellowships provide an annual honorarium of $3,000 to the holder and $1,500 to the institution at which the recipient elects to do research.

The Frank B. Jewett Fellowships will enable their recipients to devote

themselves to research in pure science for a year or two following their doctorates. Since a purpose of the fellowships is to provide for the full-time continuation of academic research, awards will normally be made to those who have obtained the doctorate within the preceding year, or are expected to receive that degree not later than the beginning of the next fellowship term which starts each July first.

The fellowships will be awarded on recommendation of the Frank B. Jewett Fellowship Committee. This committee will consist of seven members of the scientific staff of Bell Telephone Laboratories who are actively and creatively engaged in research in the respective fields of physics, mathematics, and chemistry.

In the selection for fellowship awards the primary criteria will be: demonstrated research ability of the applicant, the fundamental importance of the problem he proposes to attack, and the likelihood of his growth as a scientist.

William P. Banning Retires

WILLIAM P. BANNING, assistant vice president of the A. T. & T. Company, was retired at his own request on October 31.

For more than 20 of his 24 years in the Information Department, Mr. Banning was intimately associated with this MAGAZINE and its predecessor, the BELL TELEPHONE QUARTERLY, of which VOL. I *No. 1* appeared in 1922. During two decades of the Bell System's most rapid growth in size and in service, he helped to shape the publication's policies, arranged for the many contributions which appeared between its covers, and guided the gradual development which brought it to increasing usefulness.

Mr. Banning seldom made use of the title of "Editor," for to him the MAGAZINE was but one of the several media through which he

WILLIAM PECK BANNING

undertook to make apparent to both telephone people and the public the facts, the aims, and the policies of the Bell System.

He looked upon work in the telephone business not as a job, but as a profession, a service of a high degree of usefulness rendered to the public on a high plane and, therefore, a profession of great possibilities of satisfaction to those who worked in it. In spreading this philosophy he has rendered a service to the public and to employees of the Bell System.

For the Record

A selected list of happenings, of System interest, occurring between August 1 and October 31, 1944

RATE REDUCTIONS on telephone calls to seven Caribbean countries became effective on September 1. The reductions apply on calls to Costa Rica, Guatamala, Honduras, Nicaragua, Panama, Curaçao, and Surinam.

Message toll telephone service was opened on October 15 between the U. S. and Anchorage, Alaska.

It was announced on October 25 that rates for radio telephone calls to Hawaii, Jamaica, and the Bahama Islands were to be reduced generally, effective November 1.

Establishment of a trust fund by the A. T. & T. Company to finance five post-doctorate fellowships in physical science, in honor of Vice President Frank B. Jewett, was announced on September 21. Dr. Jewett retired from the Bell System on September 30.

On October 18, L. A. Wilson, assistant vice president in charge of the commercial division of the O. & E. Department of the A. T. & T. Company, was elected a vice president of the company, to be in charge of business research and studies of Bell System revenue requirements.

Walter S. Gifford, President of the American Telephone and Telegraph Company, delivered an address before the United States Independent Telephone Association at its annual convention in Chicago on October 11. This is the first time the Association has been addressed by a President of the American company.

The World's Telephones in War-time

Knud Fick

TOTAL WAR is war of production as well as of destruction, and the enormous productive effort achieved under stress of war by the United States would certainly have been impossible without the aid of rapid, dependable, and universal telephone service. In the last two years alone, between Pearl Harbor and the end of 1943, this country has added nearly three million telephones and two and a half million miles of telephone wire to its telephone facilities, while the total number of Long Lines conversations increased about 75 percent.

As regards the world outside the United States, the situation is less clear, largely due to the dearth of adequate statistical information. The table on the following pages, however, embodies the latest available data, gathered from a variety of sources, and indicates world totals of nearly 50 million telephones and 200 million miles of telephone wire, carrying altogether over 70 billion completed messages per year. Where countries are represented in this compilation by statistics for earlier years, no information is available as to possible expansion of telephone facilities there during the war years; neither are data available as to the extent to which existing telephone plant and manufacturing facilities have been destroyed; so that the world totals shown should be accepted as an indication of existing conditions rather than as a factual statement.

AS IN THE PAST, the telephone leadership of the world is firmly maintained by the United States, with more than half of the world's telephones and telephone wire. The more than 26 million telephones in this country correspond in number to 19.3 percent of the total population, as against 2.8 percent in Europe and an average of 0.4 percent for the rest of the world. The telephone wire in this country, similarly, amounts to four-fifths of a mile per person, or over 7 times more than in Europe and 46 times more than in the rest of the world in relation to population.

New York, with close to two million telephones, is still the leading city in the world, telephonically speaking. Next in telephonic size come the Chicago and London telephone areas, each with more than one million telephones. With more than 44 telephones per 100 inhabitants, San Francisco has the highest telephone development of any large city, closely followed by Stockholm, Sweden, with 43.5, and Washington, D. C., with 39.5, telephones for every 100 inhabitants. The average telephone development of cities in this country is about twice as high as for cities in the rest of the world.

(*Statistics on pages 206–207*)

LATEST AVAILABLE TELEPHONE STATISTICS OF THE WORLD (PARTLY ESTIMATED)

Countries	Date of Statistics	Telephones		Wire		Conversations		Telephones in Large Cities		
		Number	Per 100 Pop.	Thousands of Miles	Per 100 Pop.	Millions	Per Aver. Cap.	Exchange Area	Telephones	Per 100 Pop.
NORTH AMERICA:										
United States	Jan. 1, 1944	26,381,000	19.3*	108,000	79.1*	35,080	258.4*	New York City†	1,889,181	27.2
Canada	" 1, 1943	1,627,775	14.0	6,015	51.6	2,999	258.4	Montreal	222,056	19.6
Central America	" 1, 1942	36,797	0.4	63	0.7	—	—	—	—	—
Mexico	" 1, 1944	200,000	0.9	900	4.2	800	38.0	Mexico City	110,000	7.1
West Indies—										
Cuba	" 1, 1944	78,000	1.8	360	8.4	420	98.2	Havana	55,000	7.6
Puerto Rico	" 1, 1944	23,272	1.2	46	2.4	50	26.3	San Juan	12,000	6.9
Other W. Indies	" 1, 1942	36,064	0.4	124	1.5	—	—	—	—	—
Other N. America	" 1, 1942	25,000	6.2	28	7.0	—	—	—	—	—
Total	—	28,407,908	14.7	115,536	59.8	39,450	205.5	—	—	—
SOUTH AMERICA:										
Argentina	Jan. 1, 1942	511,880	3.8	1,862	13.8	2,178	162.4	Buenos Aires	310,002	9.0
Bolivia	" 1, 1942	2,680	0.1	6	0.2	—	—	La Paz	1,142	0.6
Brazil	" 1, 1943	331,000	0.8	1,360	3.2	1,700	40.3	Rio de Janeiro	131,384	6.6
Chile	" 1, 1942	96,641	1.9	345	6.8	300	59.3	Santiago	51,743	5.4
Colombia	" 1, 1942	43,717	0.5	200	2.2	200	21.5	Bogota	16,000	4.3
Ecuador	" 1, 1942	8,000	0.3	10	0.3	—	—	Quito	3,563	2.4
Paraguay	" 1, 1942	3,881	0.4	9	0.8	17	16.5	Asuncion	3,339	3.0
Peru	" 1, 1942	36,344	0.5	137	1.9	145	20.6	Lima	24,856	4.7
Uruguay	" 1, 1942	57,822	2.7	187	8.6	160	73.5	Montevideo	42,103	5.9
Venezuela	" 1, 1942	36,138	1.0	120	3.3	214	58.6	Caracas	25,763	8.1
Other S. America	" 1, 1942	3,552	0.6	9	1.6	—	—	—	—	—
Total	—	1,131,655	1.2	4,245	4.7	4,930	54.4	—	—	—
EUROPE:										
Belgium	Jan. 1, 1940	428,752	5.1	2,200	26.2	325	38.7	Brussels (II/28–1938)	127,639	12.9
Bulgaria	" 1, 1943	35,947	0.4	100	1.2	80	9.4	Sofia (I/1–1940)	11,686	3.3
Czechoslovakia	" 1, 1938	215,853	1.4	700	4.6	300	19.7	Prague	74,586	7.7
Denmark	Mar. 31, 1943	511,622	13.1	1,700	43.6	825	212.1	Copenhagen (I/1–1941)	223,817	24.3
Eire	" 31, 1943	49,269	1.7	160	5.4	44	14.9	Dublin	27,393	5.6
Finland	Jan. 1, 1941	186,548	5.1	330	9.0	318	86.4	Helsinki	58,508	23.4
France	" 1, 1940	1,622,680	3.9	6,230	14.8	852	20.3	Paris (I/1–1939)	437,139	15.5
Germany	June 30, 1939	4,226,504	5.3	18,500	23.0	3,700	46.2	Berlin (III/31–1939)	599,911	13.8
Gt. Britain & N. Ireland	Mar. 31, 1943	3,575,000	7.5	18,000	37.5	2,500	52.1	London	1,100,000	12.2
Greece	Jan. 1, 1940	54,404	0.8	188	2.6	130	18.4	Athens	28,029	5.5
Hungary	" 1, 1943	244,934	1.7	570	3.8	320	21.6	Budapest (I/1–1939)	107,906	6.6

Italy	" 1, 1941	685,815	1.6	1,800	4.1	1,300	29.5	Rome (I/1–1939)	122,442	9.6
Netherlands	" 1, 1942	498,223	5.5	1,600	17.8	540	60.3	Amsterdam (I/1–1939)	67,927	8.6
Norway	June 30, 1940	255,712	8.7	780	26.5	300	102.1	Oslo (VI/30–1939)	73,786	17.7
Poland	Mar. 31, 1939	294,828	0.8	1,068	3.0	621	17.8	Warsaw	90,627	7.0
Portugal	Jan. 1, 1943	86,512	1.1	210	2.7	139	17.8	Lisbon (I/1–1942)	37,701	5.3
Romania	" 1, 1943	102,742	0.6	430	2.5	230	13.5	Bucharest (I/1–1940)	50,347	5.5
Russia (U.S.S.R., incl. Siberia)	" 1, 1939	1,272,500	0.8	2,000	1.2	—	—	Moscow (I/1–1936)	144,669	3.5
Spain	" 1, 1944	393,000	1.5	2,100	7.7	870	32.2	Madrid (I/1–1942)	76,564	7.0
Sweden	" 1, 1943	1,034,000	16.0	3,900	60.4	1,400	217.7	Stockholm (I/1–1942)	200,733	43.5
Switzerland	" 1, 1944	567,517	13.2	1,950	45.4	434	101.3	Zurich (I/1–1943)	84,933	24.3
Yugoslavia	" 1, 1940	72,000	0.5	172	1.1	300	19.1	Belgrad (I/1–1939)	15,218	4.8
Other Europe	" 1, 1942	214,706	1.1	735	3.7	—	—	—	—	—
Total	—	16,629,068	2.8	65,423	11.0	17,100	28.9	—	—	—
ASIA:										
British India	Mar. 31, 1939	83,378	0.02	460	0.1	—	—	Calcutta (III/31–1941)	24,048	1.5
China	Jan. 1, 1941	160,000	0.04	600	0.1	—	—	Shanghai (IX/30–1941)	93,559	2.3
Japan	Mar. 31, 1939	1,367,958	1.9	4,864	6.7	5,339	74.2	Tokio	290,510	4.5
Other Asia	Jan. 1, 1942	333,074	0.2	1,040	0.5	—	—	—	—	—
Total	—	1,944,410	0.2	6,964	0.7	8,000	7.5	—	—	—
AFRICA:										
Egypt	Jan. 1, 1940	67,983	0.3	397	1.8	214	9.6	Cairo	29,164	2.1
Union of S. Africa	Mar. 31, 1941	235,686	2.2	1,000	9.5	320	30.7	Johannesburg	63,881	10.5
Other Africa	Jan. 1, 1942	153,751	0.1	460	0.3	—	—	—	—	—
Total	—	457,420	0.3	1,857	1.1	730	4.4	—	—	—
OCEANIA:										
Australia	June 30, 1943	766,846	10.6	3,550	49.1	687	95.4	Sydney (I/1–1942)	188,018	14.2
Hawaii	Jan. 1, 1944	67,602	12.8	186	35.1	150	291.3	Honolulu (I/1–1942)	34,014	17.0
Netherlands E. Indies	" 1, 1941	56,377	0.1	280	0.4	84	1.2	Batavia (I/1–1940)	12,356	1.8
New Zealand	Mar. 31, 1943	238,441	14.6	700	42.8	600	367.2	Auckland (III/31–1942)	35,743	16.6
Philippine Islands	Nov. 1, 1941	36,890	0.2	88	0.5	170	9.7	Manila	28,144	3.5
Other Oceania	Jan. 1, 1942	5,897	0.2	14	0.6	—	—	—	—	—
Total	—	1,172,053	1.2	4,818	4.8	1,700	17.1	—	—	—
TOTAL WORLD	—	49,742,514	2.3	198,843	9.0	71,910	32.7	—	—	—

NOTES: The above statistics incorporate the most recent information available on August 1, 1944. The total number of telephone conversations for each continent and for the world as a whole include estimates in respect of countries for which no accurate data are available.

* Based on total United States population, including military forces at home and abroad.

† The telephone development of other representative cities in the United States was, on January 1, 1944:

Chicago, Ill.	1,151,704 telephones, or 34.2 per 100 population	Milwaukee, Wis.	205,686 telephones, or 27.3 per 100 population
Los Angeles, Cal.	559,264 " " 32.9 " " "	Minneapolis, Minn.	191,872 " " 36.7 " " "
Washington, D. C.	364,204 " " 39.5 " " "	Seattle, Wash.	183,943 " " 33.6 " " "
Cleveland, Ohio	362,051 " " 31.5 " " "	Denver, Col.	129,296 " " 36.4 " " "
San Francisco, Cal.	332,428 " " 44.1 " " "	Hartford, Conn.	88,076 " " 32.7 " " "
Boston, Mass.	217,367 " " 32.0 " " "	Omaha, Neb.	80,380 " " 31.0 " " "

Robert W. King

Knud Fick

(*Continued from page 135*)

He has contributed several articles to this MAGAZINE, the most recent, in the issue for Spring, 1944, being "A Bridge for Speech across Chesapeake Bay."

IT IS certainly to be hoped that conditions will not continue to arise which would make writing about hurricanes a habit with JUDSON BRADLEY. His story of the telephone destruction and reconstruction after the New England hurricane of six years ago, "The Bell System Meets Its Greatest Test," appeared in the BELL TELEPHONE QUARTERLY for October, 1938. To write it, he visited all the New England States save Maine; but he was able to see only part of Cape Cod after last September's blow. He joined the Publicity Department of the Southern New England Telephone Company in 1925, after several years of editorial experience elsewhere, and since 1930 has been a member of the staff of the A. T. & T. Company's Information Department.

TECHNICAL and scientific publications—the *Bell Laboratories Record* and the *Bell System Technical Journal,* for instance—can appropriately appraise at length the contributions of Dr. Frank B. Jewett to the art of electrical communication and his influence upon the development of research in applied science. No more than a few pages must suffice here to mark his retirement, and ROBERT W. KING has made a point of being entirely objective about the withdrawal of the superior officer with whom he has been closely associated in recent years. In a career in science which has served the Bell System since 1917, Dr. King has been—among other things—assistant technical director in Europe for the A. T. & T. Company from 1929 to 1935, and, since 1940, assistant vice president of that company's Department of Development and Research. With Dr. Jewett's retirement, he has become Assistant to the President of the Bell Telephone Laboratories.

THAT the statistics on pages 205–207 necessarily include many an estimate which conforms with the cynic's definition of "an educated guess," their compiler, KNUD FICK, would doubtless freely admit. They are, nonetheless, the best obtainable, and are published here as a matter of record. Mr. Fick was born in Denmark, and served in the Danish Foreign Office and other branches of the Danish government until he joined the A. T. & T. Company in 1925. In the chief statistician's division of the Comptroller's Department he is in charge of statistics and economics relating to foreign telephone development. The present is his ninth contribution to the MAGAZINE and its predecessor on this topic.